bruary 1948

# Chemical Industries


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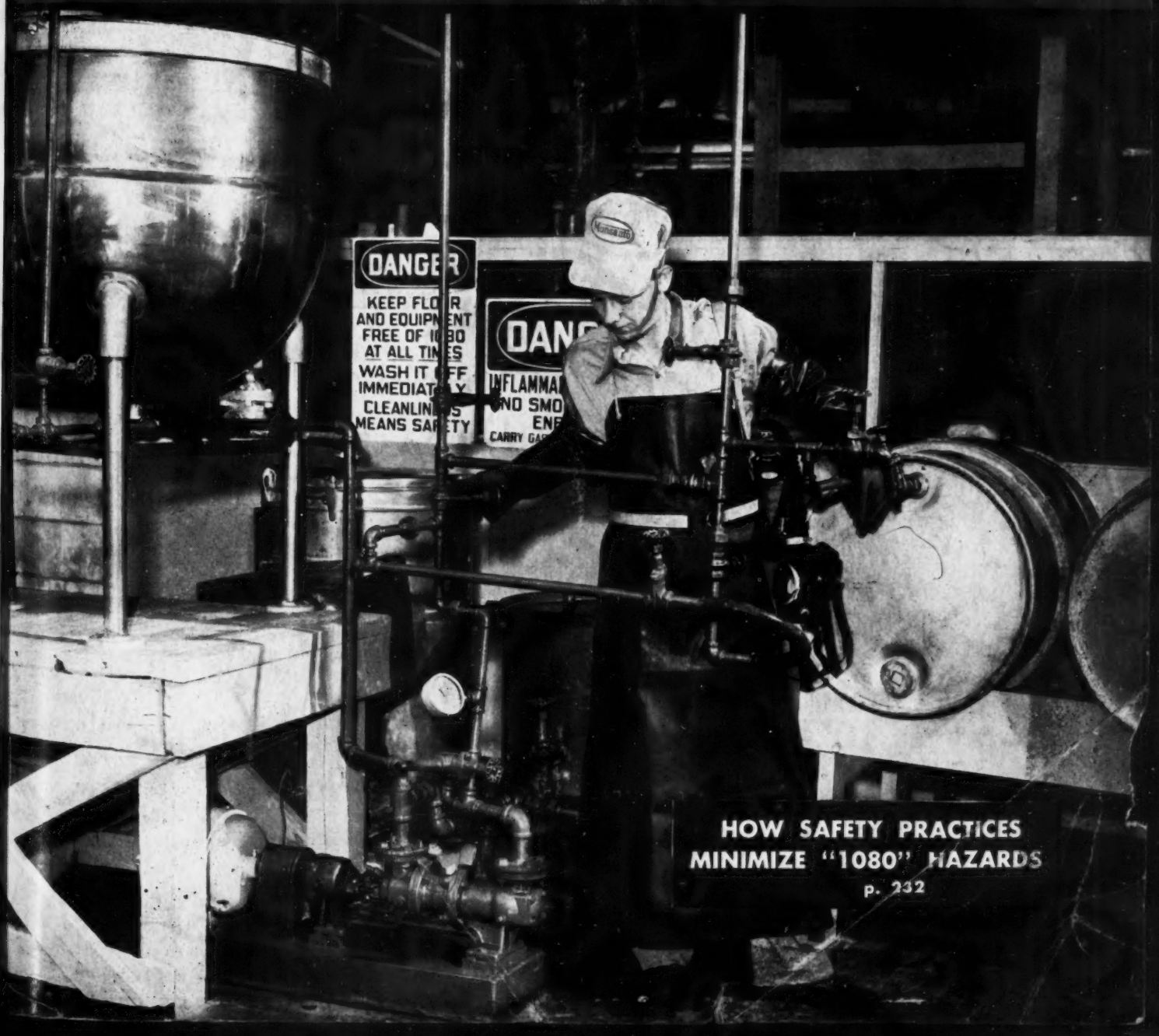


**HOW SAFETY PRACTICES MINIMIZE "1080" HAZARDS**

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# *THE STANDARD BY WHICH ALKALIES ARE JUDGED*

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TRADE MARK REG. U. S. PAT. OFF.

**PRODUCTS FOR THE PLASTICS INDUSTRY**

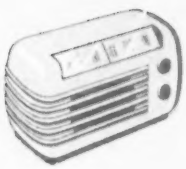
Caustic Soda

Chlorine

Soda Ash

Caustic Potash

Monochlorobenzene



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Formaldehyde is one of the most important products in the expanding family of organic chemicals produced at CHEMCEL, the Celanese plant near Bishop, Texas.

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Chemical Division
180 Madison Avenue, New York 16, N. Y.

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*Reg. U. S. Pat. Off.

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Caustic Soda...Soda Ash...Bicarbonate of Soda...Liquid Chlorine...Chlorine Dioxide Ammonia, Anhydrous & Aqua...HTH Products...Dry Ice...Carbonic Gas...Sodium Chlorite Products...Sodium Methylate.

**Mathieson**
**CHEMICALS**

# Chemical Industries

"SERVING THE CHEMICAL PROCESS INDUSTRIES"

VOLUME 62—NUMBER 2 **FEBRUARY, 1948**

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Leaded Vinyls
White Dye
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Valving CC's
Model Behavior
Synthetic Fuels
Analytical Tool
Liquid 2,4-D
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*Cover: Monsanto Chemical Co.*

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# THE READER WRITES

### *German Reparations*

*To the Editor of Chemical Industries:*

In my article on the German chemical industry published in your January 1948 issue, I said, "I have never seen a list of the chemical plants that are slated for reparations . . ."

Since that writing, I have seen such a list in *Der Tagespiegel*, October 17 and 18, 1947, and it is astounding. The majority of those listed do not come in the munitions category, but include plants manufacturing such materials as caustic soda, chlorine, synthetic resins, nylon, soap powder and other soap products—production of which are extremely important to the economic recovery of Germany. Others listed seem equally innocuous: activated carbon, acetone, acetaldehyde, ethylene oxide, ethylene glycol, ethylene dichloride, ethyl chloride, bleaching powder, alcohols (OXO process), waxes, hydrofluoric acid and fluorides.

It certainly seems that these plants should be retained in Germany and operated in their present locations. Removal of such plants only means that recovery will be that much slower, and that we shall have to pour many more dollars into the recovery program at the expense of the American taxpayer.

It is contended that in all fields ample capacities are being retained to permit the Bizone to produce at least at pre-war levels, and I have seen figures which seem to bear this out, if based on the fact that the Germany of today is only approximately three-quarters of the area of the old Germany. But what of the Russian Zone? Are the Russians retaining enough capacity for their Zone's demands? And has it been taken into consideration that Bizonia is now estimated (according to Herbert Hoover) to have a population of about 41,700,000, as against a pre-war population (1939) of 34,200,000; and, in addition, that it is expected there will be several million more returning to this area (prisoners of war and others) before the migration ceases? Have the peacetime requirements of this increased population been taken into account in the reduction of capacity by removal for reparations? And is sufficient remaining capacity planned for taking care of the requirements of the rest of Germany outside of Bizonia? The figures on Level of Industry would not indicate it

And what is Bizonia going to do for excess capacity beyond its own requirements, so that it can produce goods for export to pay for essential imports? Should plants be removed because there is no immediate prospect of supplying them with coal and raw materials for operation (it may be a matter of some years before these can be supplied), removed for inefficient operation (if they are operated at all) to Russia or other countries?

My answer to all these questions is "No." Our Government's attitude in these matters makes one wonder whether it has regard for the American taxpayer and his serious financial problems, for it is he who must pay the bill if these grave mistakes in the dismantling program are not rectified.

NORMAN A. SHEPARD
Chemical Director
American Cyanamid Co.
New York, N. Y.

### *Most Informative*

*To the Editor of Chemical Industries:*

I wish to commend the very excellent article appearing in the November issue of CHEMICAL INDUSTRIES on synthetic detergents. This is the most informative publication on this subject that has come to my attention.

PAUL LOGUE, Development Director
Phosphate Division
Monsanto Chemical Co.
St. Louis, Mo.

### *Civil Service Employees Not Required to Join Union*

*To the Editor of Chemical Industries:*

The attention of the United States Civil Service Commission has been called to a letter in the October issue of CHEMICAL INDUSTRIES. This letter, signed by William S. Mann of Healdsburg, California, states that "all Government employees in Washington and College Park, Maryland, are required to join the CIO." This statement is absolutely contrary to the fact. The majority of Federal employees do not belong to any union. The official Handbook for Commission Employees of the Civil Service Commission contains this paragraph:

"An employee may join or refrain from joining, without fear of incurring discrimination or reprisal, any employee organization which is not affiliated with an outside organization imposing upon its members an obligation to strike against the Government of the United States."

There is no basis for the statement made in the letter.

C. C. HATHAWAY, Chief
Information Division
U. S. Civil Service Comm.
Washington, D. C.

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Chemical Specialties
BABASSU OIL
Free Acid: Less than 1¾%
Color: 80 yellow; 8.1 red
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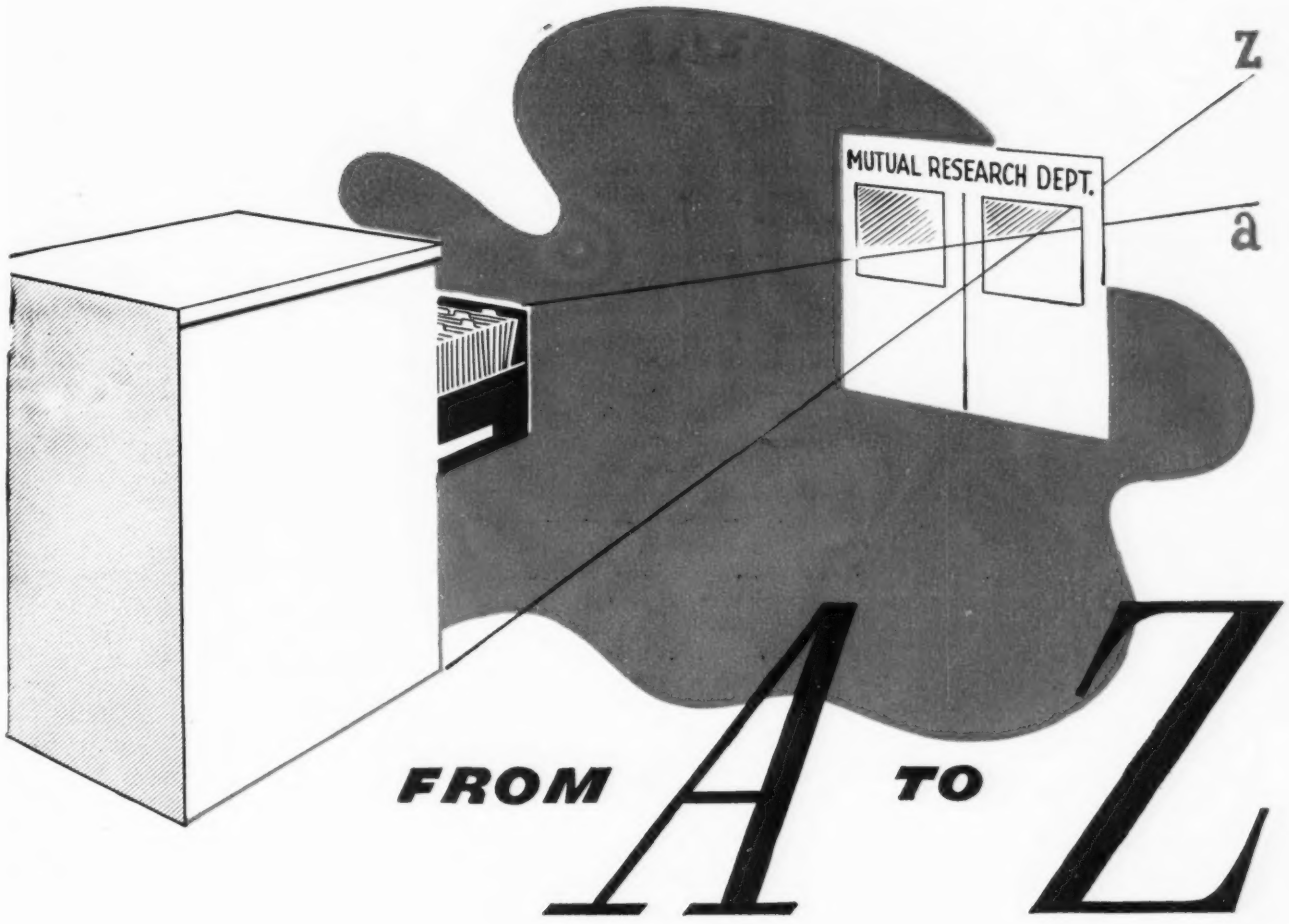


The files of our Research Department contain much valuable information regarding the use of Chromium Chemicals in many industrial applications. The following were picked at random:

| | | |
|---|---|---|
| AIR CONDITIONING | MAGNESIUM TREATMENTS | SAND BLASTING |
| BIMETALLIC CORROSION | NEW CHROMIUM CHEMICALS | TEXTILE DYEING |
| COOLING TOWERS | ORGANIC OXIDATION | WOOD PRESERVATION |
| GAS CONDENSATE WELLS | PROTEIN INSOLUBILIZATION | ZINC FINISHES |
| HYDRAULIC LIFTS | ROOFING GRANULES | |

It may be that our experience can answer some problem of yours which has defied solution in the past. Why not ask us?

**Bichromate of Soda** **Bichromate of Potash** **Chromate of Soda**
**Chromate of Potash** **Chromic Acid**

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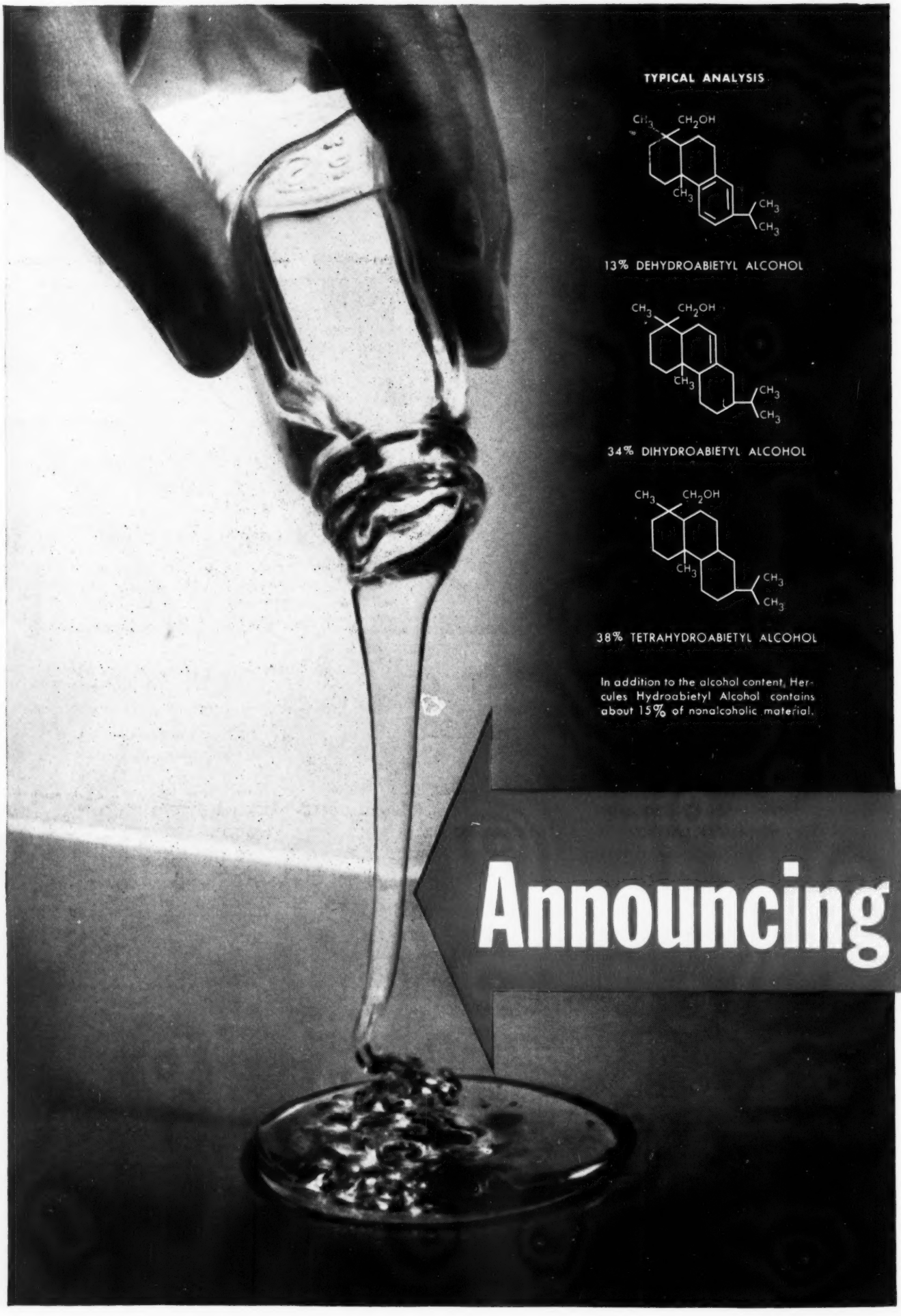
**CHROMIUM CHEMICALS**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13% DEHYDROABIETYL ALCOHOL
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38% TETRAHYDROABIETYL ALCOHOL
In addition to the alcohol content, Hercules Hydroabietyl Alcohol contains about 15% of nonalcoholic material.
Announcing . . .

For many years published research of both American and European laboratories has disclosed a wide variety of valuable products that may be derived from hydroabietyl alcohol. Now, Hercules announces the first commercial production of this interesting chemical material.

Hercules hydroabietyl alcohol is the most resistant to discoloration and degradation by light or air of all rosin derivatives. It is a viscous liquid at room temperature; is colorless, tacky, and not miscible with water, in contrast to more commonly used alcohols.

Like other high molecular weight primary alcohols, hydroabietyl alcohol is subject to esterification with both organic and inorganic acids, and etherification. It is miscible with alcohols, ketones, esters, ethers, hydrocarbons, and chlorinated hydrocarbons, and is compatible with many film-formers and resins used in protective coatings, adhesives, and other products.

Research indicates that this new rosin alcohol may be reacted to yield resins, foamers, detergents, wetting agents, emulsifying agents, plasticizers, corrosion inhibitors, antioxidants, parasiticides, bactericides, and compounds highly stable to ultra-violet light. It may be used without further chemical reaction as a modifier for chlorinated rubber, polyamides, hydrogenated oils, textile sizes, rubber compositions, and essential oil vehicles.

Never before has industry had the opportunity to investigate the potentials of this low-cost alcohol. Now, with commercial production in full swing at a new Hercules plant, hydroabietyl alcohol is immediately available to industry in quantity. Mail coupon for further technical details and a sample of hydroabietyl alcohol.

**PHYSICAL PROPERTIES**

| | |
|---|---|
| Hydroxyl Value | 5.0-5.1% |
| Per Cent Hydroabietyl Alcohol | 85-87% |
| Saponification Number (Diethylene glycol method) | 5-14 |
| Acid Number | 0.1-0.4 |
| Methoxyl Value | 0.5-1.2 |
| Unsaturation: Weight % | |
| By Hydrogen Absorption | 0.60-0.75 |
| By Bromine Number | 12-30 |
| Color (50-mm. tube)—Lovibond | 0.5 Amber |
| U. S. Rosin Standard | Z7 |
| Softening Point (Hercules Drop Method) | 33°C. |
| Specific Gravity at 20°/20°C. | 1.007-1.008 |
| Pounds/Gallon at 20°C. | 8.34 |
| Refractive Index at 20°C. | 1.528 |
| Flash Point (Cleveland Open Cup) | 185-195°C. |
| Flame Point (Cleveland Open Cup) | 217-220°C. |
| Metals (spectroscopic analysis) | Each less than 1 p.p.m. |

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# . . alcohol from rosin!

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Please send technical details on hydroabietyl alcohol ☐
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SA8-1

# TORTURE IS HIS BUSINESS

Before a resin has the right to bear the U.S.I. trademark, it goes through days of the kind of torture only modern science can devise. He sees to that.

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When he's through with them, he's sure they'll stand up in any paint, varnish, or lacquer they're designed for . . . no matter how tough the service conditions. And it's this insistence on hypercritical control that's the key to U.S.I. quality.

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| **ESTER GUMS** | *all types* |
| **CONGO GUMS** | *fused and esterified* |
| ***AROPLAZ** | *alkyd and allied materials* |
| ***AROFENE** | *pure phenolics* |
| ***AROCHEM** | *modified types* |

**NATURAL RESINS**

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| **PALE EAST INDIA** | **MANILA (Alcohol-Soluble)** |
| **BATU** | **ELEMI** |
| **BLACK EAST INDIA** | **RED GUM** |
| **PONTIANAK** | **CONGO—RAW** |
| **LOBA** | **KAURI** |

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**U.S.I. INDUSTRIAL CHEMICALS, INC.**

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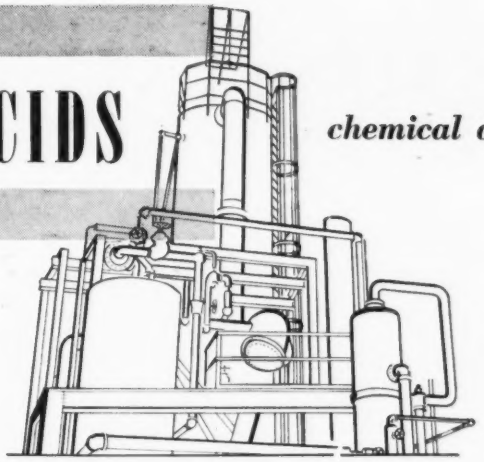
# FATTY ACIDS

***chemical data . . . product data . . . use data***



***fractional distillation***

# THE KEY TO IMPROVED PRODUCTS

Formerly the man attempting to improve his products — or to develop new ones — was limited not only by his own ingenuity, but also by the raw materials at his disposal. Today vast new fields are open to the industrial chemist because of Armour's patented fractional distillation process, which separates crude mixed fatty acids into the pure component acids. This remarkable process now makes available to industry fatty acids and fatty acid derivatives — such as amines, amides, nitriles, quaternary ammonium salts — which previously existed only in laboratory quantities.

Just a few of the widely contrasting uses of the versatile "Neo-Fats" (trade name of Armour's fractionally distilled fatty acids) are . . . ore flotation and chewing gum, soaps and rubber tires, typewriter ribbons and varnishes, chemicals and cosmetics, candles and incendiary bombs, recording cylinders and lubricating greases, shoe polishes and insecticides! These uses are just an indication of the Neo-Fats' contribution to industry today. Their variety makes possible entirely new products.

## FATTY ACIDS FOR COMPOUNDING RUBBER PRODUCTS

White sidewall stocks require non-discoloring and non-staining agents. This need is filled by Neo-Fat 1-60, which is more completely saturated than commercial double-pressed stearic acids. Neo-Fat 1-60 also contains 75% stearic acid in contrast with the 40% content of double-pressed stearic. It is a solid flaked material, easy to incorporate in open mill or Banbury mixing. Furthermore, Neo-Fat 1-60 gives faster cures with better physical and aging characteristics.

Other Neo-Fats widely used as activators, emulsifiers, mold lubricants, etc., include: Neo-Fat 1-65, HFO, D.D. Cottonseed and D.D. Animal Fatty Acids.

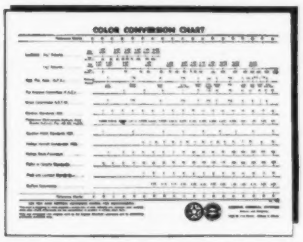
## EXPERTS DISAGREE ON BEST FATTY ACIDS FOR GREASES

Many grease compounders insist that Double Distilled Animal Fatty Acids are best for use in soft greases. Others favor D. D. Cottonseed or Corn Oil Acids.

Armour offers both types, as well as Lub-Base, a special blended and stabilized fatty acid developed especially for greases. Lub-base produces greases which by actual test are more stable to oxidation and discoloration.

For hard greases, Neo-Fats 1-54, 1-56, 1-60, 1-65, and HFO are recommended.

## FREE COLOR CONVERSION CHART


COLOR CONVERSION CHART

You can obtain Armour's 8½" x 11" color conversion chart simply by mailing in the coupon below. This chart, printed on sturdy cardboard, covers the complete commonly-used color density range. It's a valuable, time-saving reference for laboratory, technical, production and purchasing personnel.

## MODERN SOAP-MAKING PRACTICE STRONGLY FAVORS FATTY ACIDS

**Soap and Sanitary Chemicals,** leading publication of the soap industry, recently editorialized on the advantages of fatty acids over whole fats in the manufacture of soaps:

"Out of the complexities of progress in fat chemistry, a definite trend appears to be shaping up which a decade hence may mean a greatly changed soap industry. We feel that the handwriting is on the wall and the day is not too far distant when natural glycerides will no longer find their way to the soap kettle as such. Recent developments in fatty acid manufacture, fat splitting and fractionation at lower and ever lower costs, point to these materials as the future starting point in all soap manufacture. Except in the case of the largest soapers, whole oils and fats will not be processed by the soap manufacturer. Fatty acids to meet individual requirements for different types of soaps, always uniform, and lacking the drawbacks of natural glycerides, will comprise the basic raw material for the average soap kettle . . . ."

Armour produces 15 fatty acids particularly suited to soap manufacture including:

| | *Titer* | *Acid V.* | *Iodine V.* | *Color* |
|---|---|---|---|---|
| D.D. Soybean | 24°C | 198 | 135 | 5 FAC |
| D.D. Corn Oil | 30°C | 199 | 110 | 5 FAC |
| D.D. Cottonseed | 37°C | 200 | 105 | 5 FAC |
| Neo-Fat 3 | 23°C | 198 | 120 | 7 FAC |
| Neo-Fat S-142 | 17°C | 190 | 130 | 5 FAC |

## PRODUCT SPECIFICATIONS

*Neo-Fat 7* (90% Caprylic Acid) Melting Point, 13° C; Iodine Value (Wijs), 0.8; Acid Value, 385.

Uses: Essences, synthetic perfumes, plasticizers, pharmaceuticals, chemical intermediates.

*Neo-Fat 15* (90% Capric Acid) Melting Point, 30.0° C; Iodine Value, 1.2; Acid Value, 324.

Uses: Flavors, essences, germicides, anti-foaming agents, dyestuffs, chemical intermediates.

*Neo-Fat 11* (90% Lauric Acid) Melting Point, 38.0°C; Iodine Value, 1.0; Acid Value, 276.

Uses: Detergents, metallic soaps, shampoos, shave creams, alkyd resins, chemical intermediates.

*Double Distilled Coconut Fatty Acids:* Mixed coconut fatty acids stripped free of the short-chain acids (caproic, caprylic, capric).

Uses: Soaps, shampoos, emulsions, alkyds, plasticizers.

## LAURIC ACID SUPERIOR FOR HIGH BAKE ENAMELS

White baking enamels formulated from a melamine alkyd combination have materially better color stability at high temperature schedules when the alkyd is formulated from Neo-Fat 11 (Lauric Acid).

It has been well-established that a chain length of 12 carbons (lauric acid) is the optimum length for producing plasticizing alkyds for high temperature bakes. Neo-Fat 11 with its very high lauric acid content has almost complete freedom from unsaturated compounds and is ideal for high bake enamels.

## SEND FOR "THE CHEMISTRY OF FATTY ACIDS"

This 12-page Armour booklet furnishes basic information on the fatty acids and their derivatives in concise and readable form. Available upon request — without charge. Mail in coupon below.

**Individual data sheets** are available on each of the fatty acid products mentioned on this page. Indicate on coupon below any particular sheets you would like to have.

**Mail this coupon today!**

(*Attach to your business letterhead, please*)

Please send me, without charge, items checked below.

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☐ Booklet, "The Chemistry of Fatty Acids"

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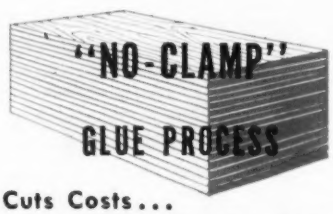
# FOR YOUR INFORMATION

## MONSANTO ORTHODICHLOROBENZENE

### 24 IMPORTANT USES

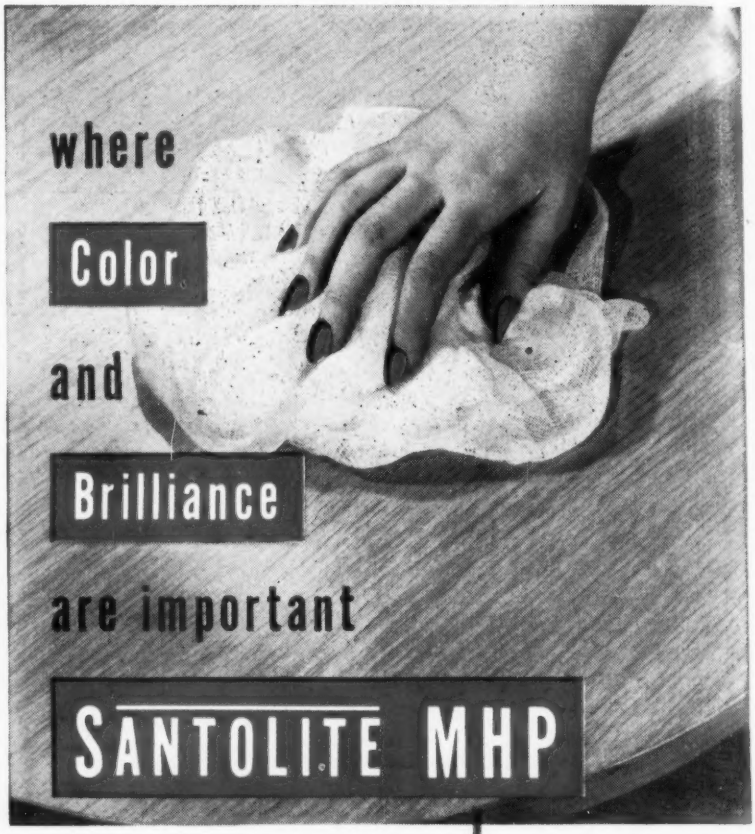
Orthodichlorobenzene is a versatile Monsanto product with a wide range of chemical and physical applications. It is insecticidal, has high solvent characteristics and low toxicity—a combination which makes it applicable to many important uses in the chemical and processing industries. Listed below are suggested uses for orthodichlorobenzene. For more detailed information you are invited to contact Monsanto.

| | |
|---|---|
| Automotive Solvents | Wool Scouring |
| Insecticides | Odor and Fly Control |
| Sewage Disposal | Petroleum Products |
| Paints and Surface Coatings | |
| Dry Cleaning | Weed Killing |
| Metal Polishes | Leather Dyeing |
| Shoe Polishes | Insect Repellents |
| Paint and Varnish Removers | Commercial Solvents |
| Wire Cleaning | Hide Protection |
| Termite Control | Entraining Agents |
| Machine Shop Solvents | Soil Disinfectants |
| Gas Purification | Cosmetic Processing |




### Cuts Costs... Simplifies Production

A recent development of Monsanto's Western Division, the "No-Clamp" Glue Process effects important time and labor economies in plywood production. Applicable to both western fir and eastern hardwood, the new process makes possible flatter panels, fewer rejects, easier handling, reasonable drying cost and strong, water-resistant bonds. The plywood load is left in the press for as little as 15 minutes—compared with the previous practice of storing individual loads in clamps for periods ranging from 2 to 6 hours. Ask for further information on the No-Clamp Process. Write, or use the convenient coupon.




The brilliance, high gloss, clarity and hardness which Santolite MHP imparts will be of interest to manufacturers of lacquers and finishes. Now available in increasing quantities, Santolite MHP will improve the formulation and performance of decorative, utility and protective coatings.

Santolite MHP is compatible not only with the generally used film-formers, but also with zein, casein, shellac and cellulose acetate... The excellent solvent power of Santolite MHP makes possible the use of resins, plasticizers and modifying agents not compatible with the film-former alone, yet having properties desirable in the end product... Other valuable qualities which Santolite MHP imparts to films and coatings are: good adhesion, reduction of moisture permeability, resistance to hydrocarbons and economies resulting from high solids lacquer applications.

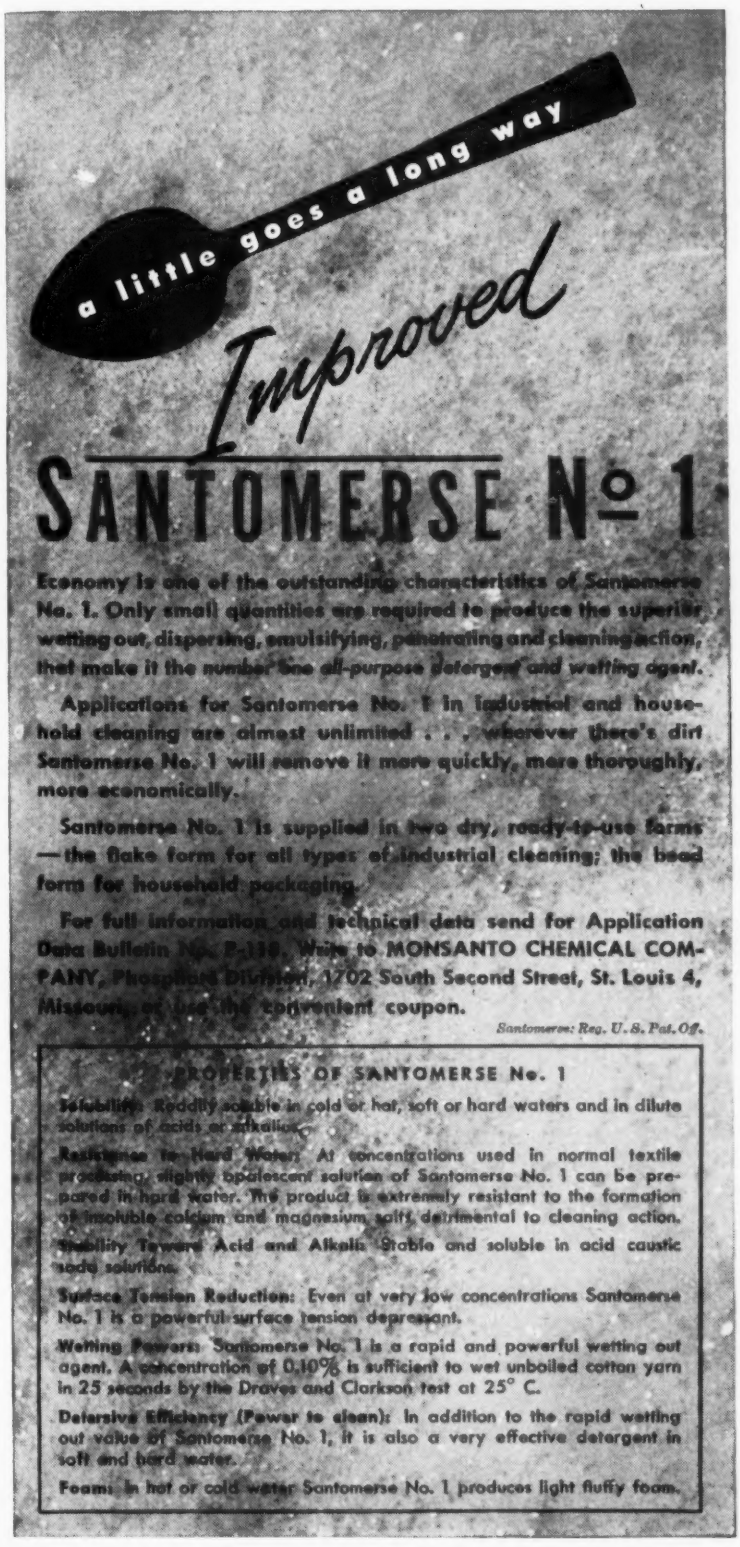
For further information and technical data on Santolite MHP and other Monsanto plasticizers and resins, write to MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1703 South Second St., St. Louis 4, Missouri. Return the coupon if you find it more convenient.

### OUTSTANDING COMPATIBILITY

**Santolite MHP is compatible and useful with a wide range of film-formers, including:**

Allyl Starch
Benzyl Cellulose
Casein
Cellulose acetate
Cellulose acetate butyrate
Cellulose nitrate
Cellulose propionate
Chlorinated rubber
Ethyl cellulose
Pliolite
Polyamides
Polyvinyl acetate
Polyvinyl butyral
Polyvinyl chloride
Polyvinyl co-polymers
Shellac
Zein

# News of Monsanto Chemicals for the Process Industries . . . February, 1948




**Economy is one of the outstanding characteristics of Santomerse No. 1. Only small quantities are required to produce the superior wetting out, dispersing, emulsifying, penetrating and cleaning action, that make it the number one all-purpose detergent and wetting agent.**

**Applications for Santomerse No. 1 in industrial and household cleaning are almost unlimited . . . wherever there's dirt Santomerse No. 1 will remove it more quickly, more thoroughly, more economically.**

**Santomerse No. 1 is supplied in two dry, ready-to-use forms —the flake form for all types of industrial cleaning; the bead form for household packaging.**

**For full information and technical data send for Application Data Bulletin No. P-118. Write to MONSANTO CHEMICAL COMPANY, Phosphate Division, 1702 South Second Street, St. Louis 4, Missouri, or use the convenient coupon.**

*Santomerse: Reg. U. S. Pat. Off.*

**PROPERTIES OF SANTOMERSE No. 1**

**Solubility:** Readily soluble in cold or hot, soft or hard waters and in dilute solutions of acids or alkalies.

**Resistance to Hard Water:** At concentrations used in normal textile processing, slightly opalescent solution of Santomerse No. 1 can be prepared in hard water. The product is extremely resistant to the formation of insoluble calcium and magnesium salts, detrimental to cleaning action.

**Stability Toward Acid and Alkali:** Stable and soluble in acid caustic soda solutions.

**Surface Tension Reduction:** Even at very low concentrations Santomerse No. 1 is a powerful surface tension depressant.

**Wetting Powers:** Santomerse No. 1 is a rapid and powerful wetting out agent. A concentration of 0.10% is sufficient to wet unboiled cotton yarn in 25 seconds by the Draves and Clarkson test at 25° C.

**Detersive Efficiency (Power to clean):** In addition to the rapid wetting out value of Santomerse No. 1, it is also a very effective detergent in soft and hard water.

**Foam:** In hot or cold water Santomerse No. 1 produces light fluffy foam.

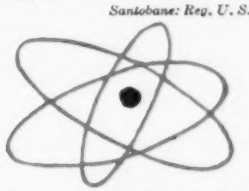
## SANTOBANE

**(Monsanto DDT)**

Exhaustive tests have proved proper formulations of Santobane effective against *all four* major insect groups—household, premise, animal and agricultural. Furthermore, it kills in two of the three possible ways: 1. As a stomach poison; 2. As a contact poison.

Formulators of insecticides prefer to work with Santobane because of its uniform, free-flowing, granular characteristics—which permit it to be readily solubilized, emulsified or milled. Further information and technical data are available in a new Monsanto folder on Santobane. Write for your copy, or return the convenient coupon.

*Santobane: Reg. U. S. Pat. Off.*



## Monsanto's New Role in Atomic Energy

Construction is proceeding rapidly at Miamisburg, Ohio, where Monsanto will operate a new facility for the Atomic Energy Commission. Situated ten miles south of Monsanto's Central Research Laboratories in Dayton, this will be one of the most important atomic energy installations in America.

MONSANTO CHEMICAL COMPANY, 1703 South Second St., St. Louis 4, Mo. District Sales Offices: New York, Philadelphia, Chicago, Boston, Detroit, Cleveland, Cincinnati, Charlotte, Birmingham, Houston, Akron, Los Angeles, San Francisco, Seattle. In Canada: Monsanto (Canada) Limited, Montreal.

MONSANTO
CHEMICALS — PLASTICS

**SERVING INDUSTRY . . . WHICH SERVES MANKIND**

MONSANTO CHEMICAL COMPANY
1703 South Second Street, St. Louis 4, Missouri

I would like further information and technical data on the following:

_____

Name_____ Title_____

Company_____

Address_____

City_____ State_____

# Investigate Cowles DRYMET*

**DRYMET** is commercial anhydrous sodium metasilicate. DRYMET contains no water—combined or uncombined. It is the most highly concentrated form of metasilicate on the market.

**DRYMET** yields more chemical value per pound than other detergent silicates —and it is priced to yield more chemical value per dollar.

**DRYMET** is readily soluble in all practical concentrations at all practical temperatures.

**DRYMET** has a total alkalinity as $Na_2O$ of not less than 50%.

**DRYMET** yields a pH of 11.55 in a .06% solution. DRYMET will improve the detergent efficiency of practically every alkaline solution.

Write for DRYMET File Folder containing complete technical information and suggested formulations.

***DRYMET** is available for immediate shipment.*

*Reg. U. S. Pat. Off.

## The Cowles Detergent Company

HEAVY CHEMICALS DEPARTMENT

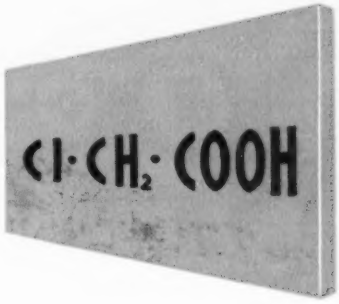
7012 EUCLID AVENUE • CLEVELAND 3, OHIO

*Its Readily Substituted Chlorine makes*

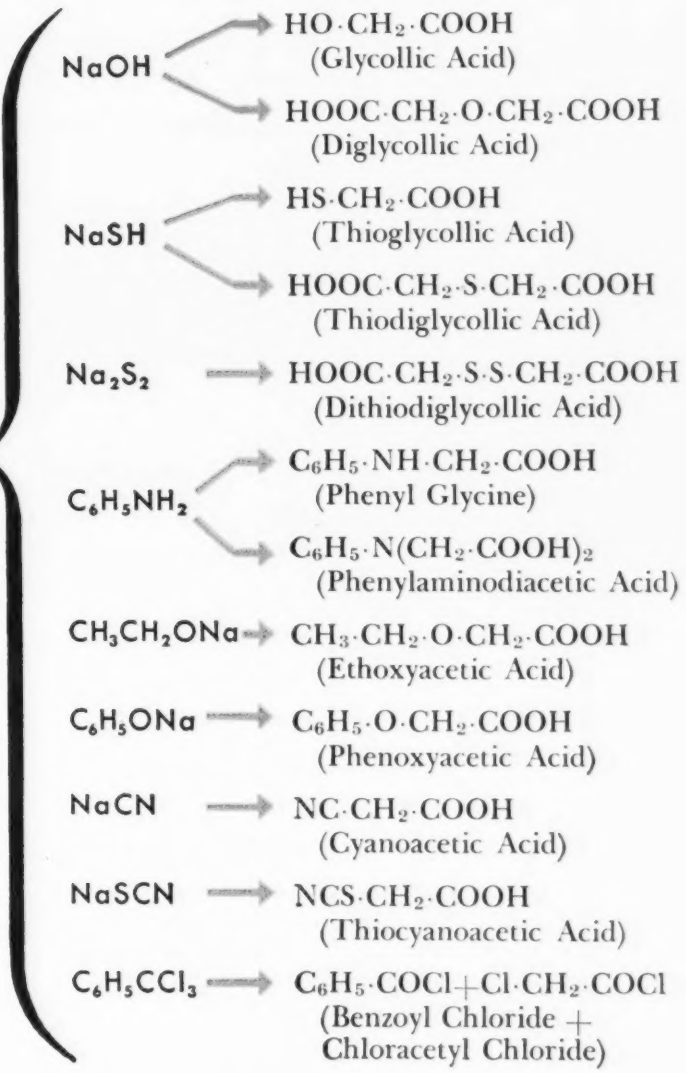
# MONOCHLORACETIC ACID

## *an important Intermediate*

This versatile chemical is now being produced by Hooker as a technical grade material. Its ability to react readily with many different reagents is indicated by a few of the typical reactions shown.




Hooker Monochloracetic Acid is a fine, white, free flowing flake material with a sweetish odor. The technical grade has a minimum monochloracetic acid content of 98%, a maximum of 2% dichloracetic acid, and a melting point of 60° C min.




Additional physical and chemical data are given in Technical Data Sheet 752. Literature and samples are available when requested on your company letterhead.

**HOOKER ELECTROCHEMICAL COMPANY**

3 Forty-Seventh St., Niagara Falls, N. Y.
New York, N. Y. Wilmington, Calif. Tacoma, Wash.

**HOOKER CHEMICALS**

**Caustic Soda Muriatic Acid Sodium Sulfide Paradichlorbenzene Chlorine Sodium Sulfhydrate**

# ITACONIC ACID

$$CH_2 = C(-COOH)-CH_2-COOH$$

**Now Available From Our Pilot Plant For Larger Scale Investigations Or Customer Acceptance Tests.**

This unsaturated dibasic acid has shown promise as a raw material for the preparation of resins of alkyd and other types, for the preparation of surface-active agents, and in chemical synthesis.

Its esters can be polymerized alone or co-polymerized with other monomers to produce resinous materials of widely varying characteristics.

*We will be very pleased to quote prices on request*

## Chas. PFIZER & Co., Inc.

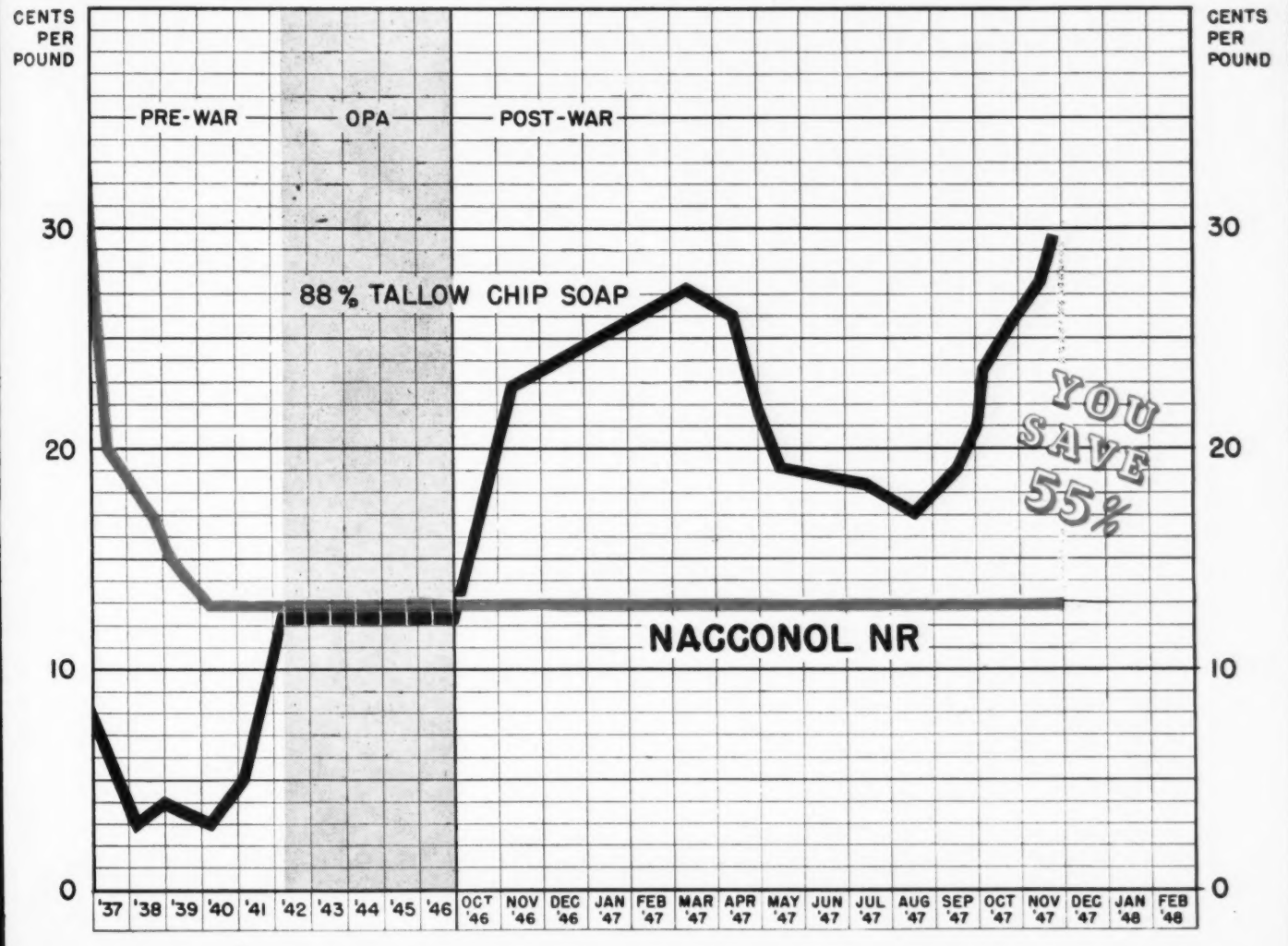
*Manufacturing Chemists Since 1849*

81 Maiden Lane, New York 7, N. Y. • 444 West Grand Avenue, Chicago 10, Ill.
605 Third Street, San Francisco 7, Calif.

6309

*Pictures Speak Louder Than Words*

## COST COMPARISON - NACCONOL NR vs SOAP


CENTS PER POUND
CENTS PER POUND
PRE-WAR
OPA
POST-WAR
30
20
10
0
88% TALLOW CHIP SOAP
NACCONOL NR
YOU SAVE 55%
'37 '38 '39 '40 '41 '42 '43 '44 '45 '46 OCT '46 NOV '46 DEC '46 JAN '47 FEB '47 MAR '47 APR '47 MAY '47 JUN '47 JUL '47 AUG '47 SEP '47 OCT '47 NOV '47 DEC '47 JAN '48 FEB '48

*Adopt* **NACCONOL NR**
*and cut your soap costs*

National Aniline DIVISION • ALLIED CHEMICAL & DYE CORPORATION

40 RECTOR ST., NEW YORK 6, N.Y. • BOSTON • PROVIDENCE • PHILADELPHIA • CHICAGO • SAN FRANCISCO • PORTLAND, ORE. GREENSBORO • CHARLOTTE • ATLANTA • NEW ORLEANS • CHATTANOOGA • TORONTO

# *Free from Government Control*

# QUININE

## *Available in Adequate Quantities*

*Merck & Co., Inc. is now in a position to supply your requirements for the following Quinine salts:*

**Quinine Alkaloid**
**Quinine Bisulfate**
**Quinine Dihydrochloride**
**Quinine Hydrochloride**
**Quinine Hydrobromide**
**Quinine Phosphate**
**Quinine Salicylate**
**Quinine Sulfate**

**Quinine and Urea Hydrochloride**

Now entirely free from Government control, these Quinine salts are available for the manufacture of proprietary products, cold tablets, chill tonics, industrial and other products, as well as for antimalarial therapy.

Cinchonine and Cinchonidine in the form of alkaloid and usual salts, as well as minor Quinine salts, will be available soon. It is expected that Quinidine Alkaloid and Sulfate will continue in short supply and hence remain under allocation.

*We Invite You to Write Us Regarding Your Manufacturing Problems and Requirements*

MERCK & CO., Inc. *Manufacturing Chemists* RAHWAY, N. J.

New York, N. Y. • Philadelphia, Pa. • St. Louis, Mo. • Elkton, Va. • Chicago, Ill. • Los Angeles, Calif.

*In Canada:* MERCK & CO., Ltd. Montreal • Toronto • Valleyfield

DOUBLE CHECKED from RESEARCH to INDUSTRY

# SHARSOL

## SHARSOL 221

### ADVANTAGES FOR SOLUBILIZING 2,4-D ACID

- **MOST ECONOMICAL:** Concentrates containing one pound of 2,4-D per quart of solution can be formulated more economically with SHARSOL 221 than with other solubilizers now available. Only 140 pounds of SHARSOL 221 (anhydrous basis) are required to make 100 gallons of the concentrate.
- **EASY TO USE:** Formulation may be carried out in standard equipment, requiring only moderate heating and agitation.
- **READILY AVAILABLE:** Whether you wish to purchase drum quantities or tank cars, prompt shipment can be made.

*ASK FOR SAMPLES AND FURTHER INFORMATION*

SHARPLES TRADE MARK CHEMICALS

**SHARPLES CHEMICALS INC.**

PHILADELPHIA CHICAGO NEW YORK

# SHARPLES SYNTHETIC ORGANIC CHEMICALS

PENTASOL* (AMYL ALCOHOLS) BURAMINE* (BUTYL UREA, Tech.)
ORTHOPHEN* (o-AMYLPHENOL)
PENT-ACETATE* (AMYL ACETATE) PENTAPHEN* (p-tert-AMYLPHENOL)
PENTALARM* (AMYL MERCAPTAN) VULTACS* (ALKYL PHENOL SULFIDES)
PENTALENES* (AMYL NAPHTHALENES)

AMYLAMINE ETHYLAMINE BUTYLAMINE
DIAMYLAMINE DIETHYLAMINE DIBUTYLAMINE
TRIAMYLAMINE TRIETHYLAMINE TRIBUTYLAMINE
DIETHYLAMINOETHANOL
ETHYLETHANOLAMINES 161
DI-sec-AMYLPHENOL
TETRAETHYLTHIURAM DISULFIDE
TETRAETHYLTHIURAM MONOSULFIDE
TETRAMETHYLTHIURAM DISULFIDE
ZINC DIETHYLDITHIOCARBAMATE
ZINC DIMETHYLDITHIOCARBAMATE
ZINC DIBUTYLDITHIOCARBAMATE
SELENIUM DIETHYLDITHIOCARBAMATE

AMYL CHLORIDES o-tert-AMYLPHENOL o-sec-AMYLPHENOL
DICHLORO PENTANES DI-tert-AMYLPHENOL AMYL SULFIDE
DIAMYLPHENOXYETHANOL

* Trademark Registered

## SHARPLES CHEMICALS INC.

EXECUTIVE OFFICES: PHILADELPHIA, PA.
PLANT: WYANDOTTE, MICH.

*Sales Offices*

NEW YORK CHICAGO

West Coast: MARTIN, HOYT & MILNE, INC., Los Angeles . . San Francisco . . Seattle
Mining Representative: ANDREW CLAUSEN, 1826 Herbert Ave., Salt Lake City 5, Utah
Canada: SHAWINIGAN CHEMICALS LTD., Montreal, Quebec . . Toronto, Ontario
Export: AIRCO EXPORT CORP., New York City

# STANDARD

## BICHROMATE OF SODA

## BICHROMATE OF POTASH

## CHROMATE OF SODA

PRIOR CHEMICAL CORPORATION - NEW YORK

420 LEXINGTON AVENUE

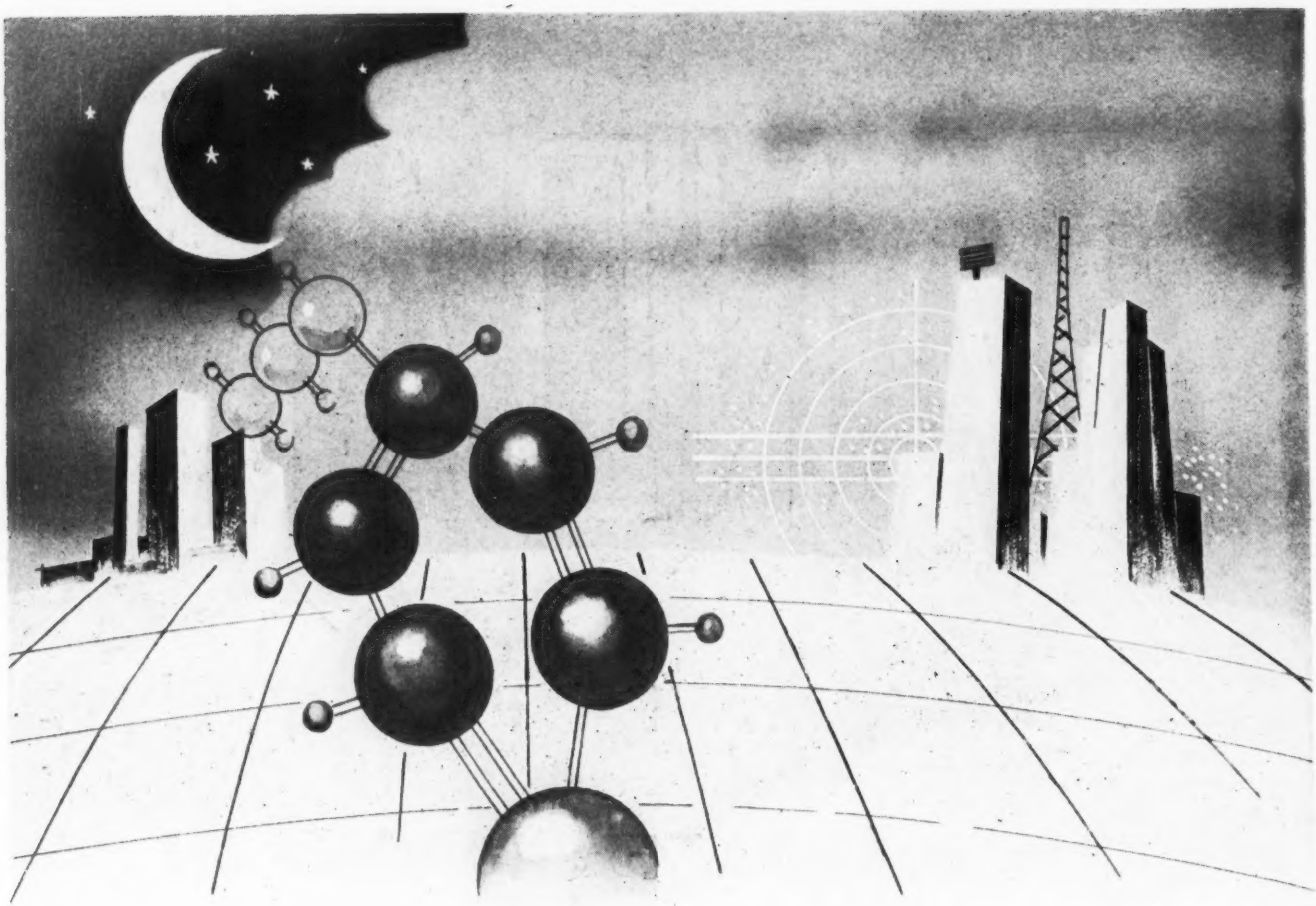
Chicago Office: 230 North Michigan Ave.

*Selling Agents for*

STANDARD CHROMATE DIVISION

Diamond Alkali Company, Painesville, Ohio

Make "Standard" BICHROMATES your standard



# NEW HORIZONS in PURIFICATION

Chemistry is advancing by leaps and bounds and almost every day we read about products that open up broad new vistas in the world of medicine and pharmaceutical chemistry. Behind these headlines, and helping to make them possible, are contributing factors about which the public seldom hears.

Keeping abreast of these new horizons in chemistry is Nuchar Activated Carbon. Nuchar—due to its "specificity and selectivity"—can be employed for the recovery of valuable and active constituents from a mixture of materials in solution, by selectively adsorbing the desired compound. It may be possible that with proper adsorption and desorption techniques, valuable products such as hormones, vitamins, pharmaceuticals, etc., can be concentrated and recovered in a manner similar to the procedures employed for penicillin and streptomycin.

If you have products used for human consumption whose chemical purity must be of the highest quality, it is quite possible that Nuchar Activated Carbon can attain the required purity where other purification methods have failed.

**industrial CHEMICAL SALES**

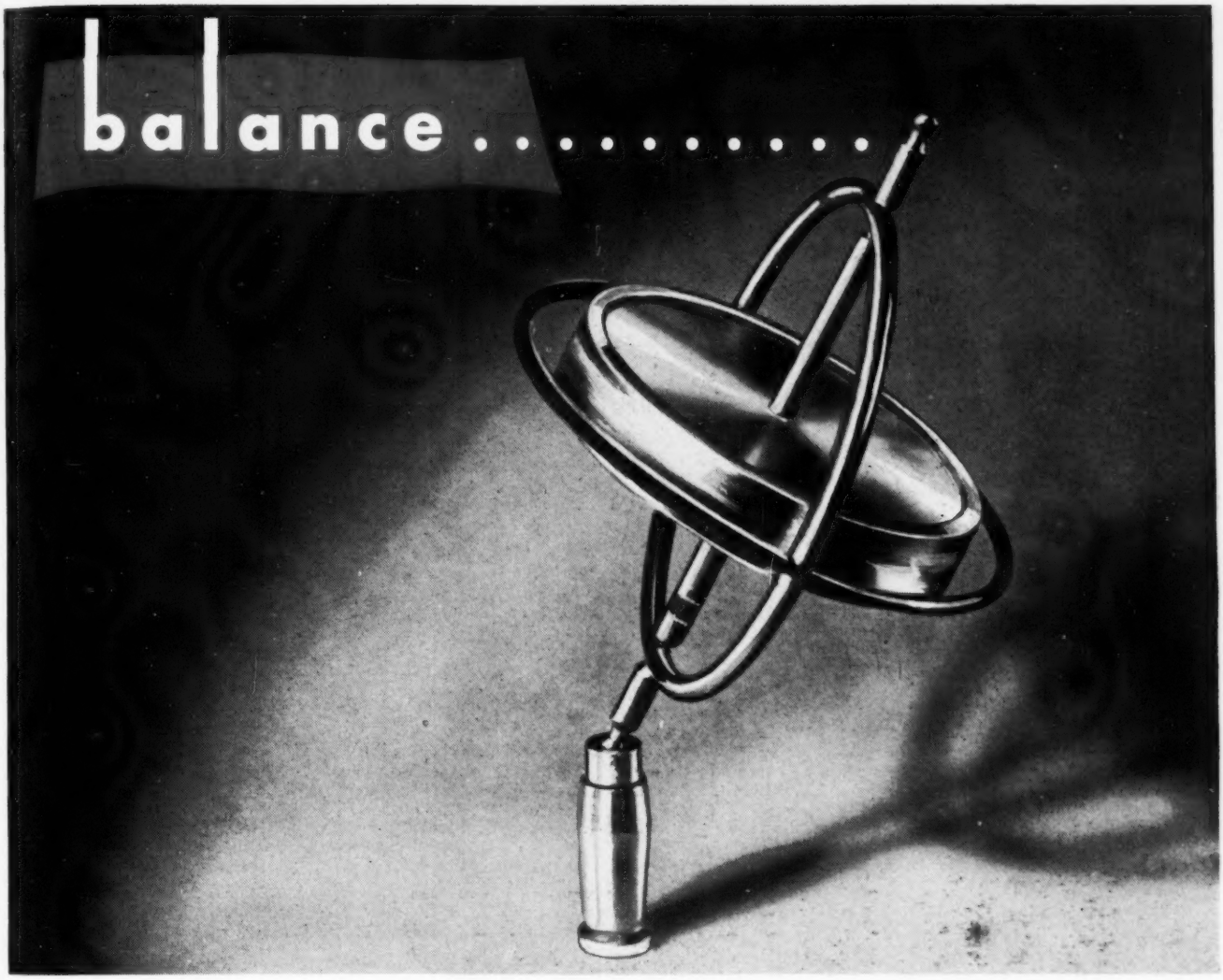
**division west virginia pulp and paper company**

230 Park Avenue
New York 17, N. Y.

35 E. Wacker Drive
Chicago 1, Illinois

6th and Chestnut Streets
Philadelphia 6, Pa.

844 Leader Bldg.
Cleveland 14, Ohio




• Fascinating to watch are the spectacular balancing effects produced by a gyroscope.

You'll find that your formulas, too, are in balance when you stabilize with Kelco Algin, the modern stabilizing and suspending agent.

Kelco Algin products have successfully demonstrated their ability to assure uniform suspension and stability in such varied applications as food and dairy products, cold-water paints, adhesives, latex compounds, pharmaceutical ointments and emulsions, tooth paste, textile printing pastes, paperboard sizing, and numerous other commercial needs.

A product of nature, Kelco Algin is processed to exacting standards that insure consistently uniform results. It is completely free of impurities; economical and easy to use and is highly adjustable to critical changes of environment.

A request from you will bring full details as to its suitability to your particular requirements.

# KELCO
## COMPANY

**20 N. Wacker Drive**
**CHICAGO—6**

**31 Nassau Street**
**NEW YORK—5**

**530 W. Sixth Street**
**LOS ANGELES—14**

Cable Address: **KELCOALGIN**—New York

Direct Firing Antiquated in Food Industry

INCREASE YIELDS

Nth Degre In He

New High Salt Unit Processin

Heat Pro Given "

New Be Brings To Ind

Americ Be

Again we poin Company of B

Paint In Help

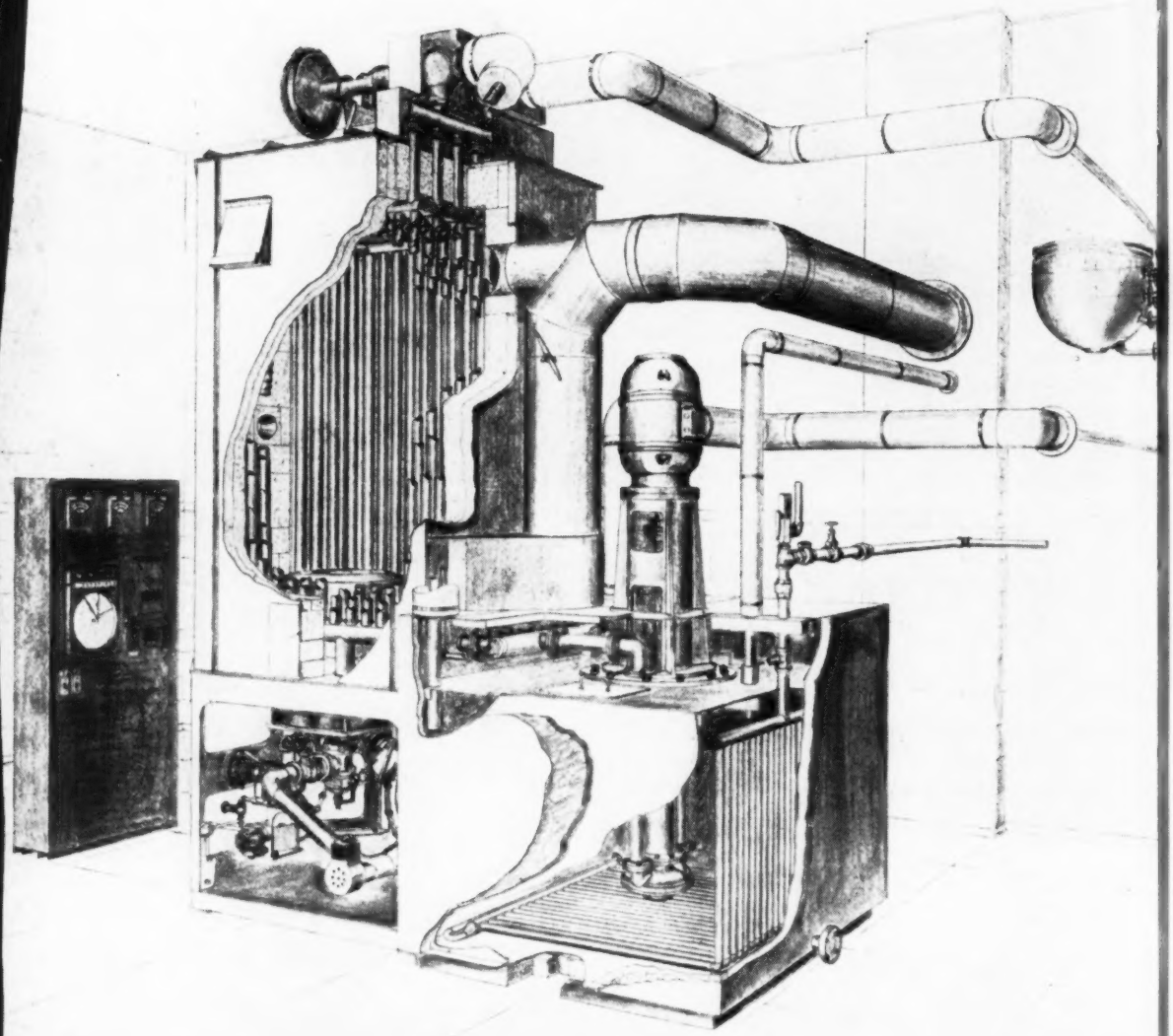
New U Lowe

New Unit Between

Precision Processing Brought To Chemical Industry

New High

# MAKING NEWS



# BETHLEHEM FOUNDRY

# IN PROCESSING

**New and Revolutionary**

# BETH-TEC UNIT

**with precision heat at temperatures up to 800°F.**
**. . . low investment . . . high thermal efficiency.**

Hailed by the press of the nation, this new and revolutionary unit offers industry greater efficiency in heat processing at high temperatures. Here is the answer to economical, precision heat between flame and steam temperatures with no detectable vapor pressures.

The Beth-Tec† Unit has been designed . . . developed . . . and proved to provide safe, dependable, reliable service at a cost far below that of any other equipment aimed at attaining the same results. It utilizes a medium known as "Hi-Tec"* heat transfer salt, developed by Du Pont chemists whose able cooperation with Bethlehem engineers has made possible this new Beth-Tec Unit.

The unit is a completely automatic, self-contained "package" including all "fail-safe" instruments. It brings precision heat processing within a price range never before possible for many manufacturers. These "performance-proved" units are now available from 500,000 B. T. U.'s per hour to 2,500,000 B. T. U.'s per hour in continuous operation at 650°F.

If you are interested in lowering your costs of heat processing here is the unit you should investigate now! Full details on the specifications of the unit, data pertaining to heat transfer medium and operating information are available in the new folder "BETH-TEC UNIT" — write today for your copy.

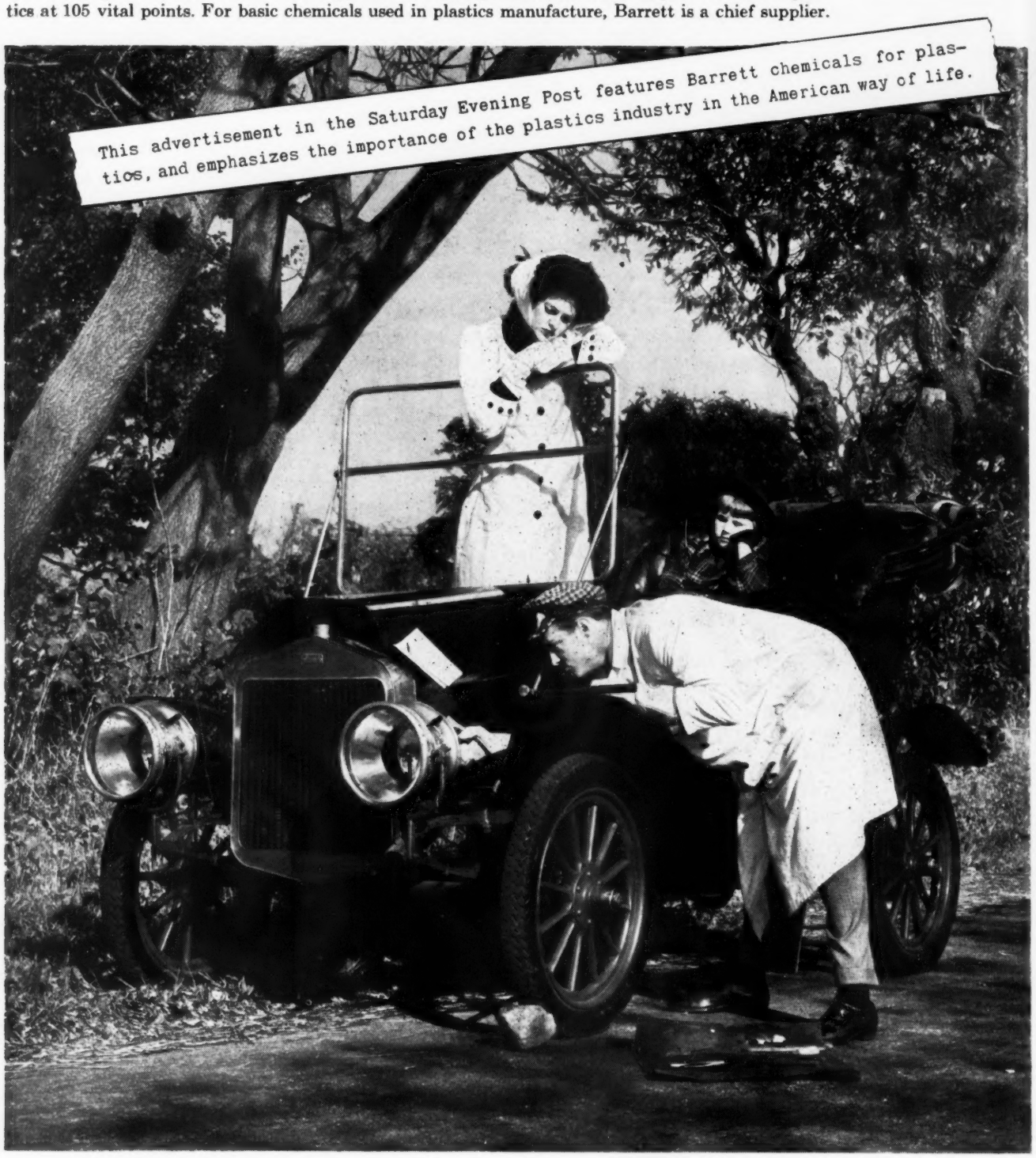
Bethlehem engineers take this opportunity to acknowledge with thanks the cooperation of the following contributing companies who have made possible the perfection of this unit:

E. I. du Pont de Nemours & Co., Inc.
Bristol Instrument Company
Lawrence Pump Company
Instrument Associates, Inc.
Wheelco Company, Inc.
Hauck Oil Burner Company
Hammel-Dahl Valve Company

†Trade Mark Applied for, U. S. Pat. Office, Bethlehem Foundry and Machine Co.
*Trade Mark Reg. U. S. Pat. Office, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

**AND MACHINE COMPANY**
**BETHLEHEM, PENNA.**

**MOTORING WITH FATHER** is a lot easier on the nerves now that father drives a modern car! Behind the smooth performance and handsome appearance of today's automobiles is the judicious use of plastics at 105 vital points. For basic chemicals used in plastics manufacture, Barrett is a chief supplier.


This advertisement in the Saturday Evening Post features Barrett chemicals for plastics, and emphasizes the importance of the plastics industry in the American way of life.

**HOW BARRETT SERVES THE AUTOMOTIVE INDUSTRY.** Barrett is a key source of supply for coal-tar chemicals used in the manufacture of plastics for laminated gears, brake linings and clutch facings, dash panel knobs and ornaments, finishes and upholstery trim, and a wide variety of other uses from distributor heads to tail light assemblies. Barrett also supplies rubber compounding materials for better tires and rubber parts, deadening felt for bodies . . . and Tarvia* road-tar for roads that add to your motoring enjoyment. These and other Barrett products establish Barrett as **ONE OF AMERICA'S GREAT BASIC BUSINESSES.**

Barrett*

**THE BARRETT DIVISION**
**ALLIED CHEMICAL & DYE CORPORATION**
**40 Rector Street, New York 6, N. Y.**

**BARRETT CHEMICALS FOR INDUSTRY**

Phenols
Cresols
Cresylic Acids
Chlorinated Tar Acids
Xylenols
Pickling Inhibitors
Benzene
Toluene
Xylene
Naphthalene
Hi-Flash Solvent
Phthalic Anhydride
Dibutyl Phthalate
Dicyclohexyl Phthalate
Plasticizer 50 B
Niacin (Nicotinic Acid)
Pyridines
Picolines
Quinoline
Tar Acid Oils
Neutral Coal-Tar Oils
Creosote Oil
CUMAR* Paracoumarone-Indene Resin
Carbonex* Rubber Compounding Material
Bardol* Rubber Compounding Material
Cyclohexanol
Flotation Agents
Anhydrous Ammonia
Ammonia Liquor
Sulphate of Ammonia
Ammonium Nitrate
Arcadian* The American Nitrate of Soda

*Reg. U. S. Pat. Off.

# Baker's INDUSTRIAL CHEMICALS

ACID HYDROCHLORIC, C.P. ACS
ACID LACTIC, N.F., 85% Liquid
ACID MOLYBDIC, C.P. 85% Powder
ACID MOLYBDIC, Purified 85%
ACID NITRIC, C.P.
ACID NITRIC, Technical
ACID PHOSPHORIC, N.F., 85% Syrupy
ACID SALICYLIC, U.S.P., Needle Crystal or Powder
ACID SILICIC, C.P. Powder,
ACID SILICIC Fluorescent Grade
ACID SULFURIC, C.P.
ACID TANNIC, (Tannin), U.S.P., Powder
ACID TUNGSTIC, C.P.
ACID TUNGSTIC, Purified Powder
AMMONIUM ACETATE Purified Crystal
AMMONIUM BROMIDE NF Granular
AMMONIUM CHLORIDE, U.S.P. Granular
AMMONIUM DICHROMATE, Photo Granular
AMMONIUM DICHROMATE, Crystal
AMMONIUM HYDROXIDE, C.P. 26°
AMMONIUM IODIDE, NF
AMMONIUM MOLYBDATE, C.P.
AMMONIUM MOLYBDATE, Fine Crystal
AMMONIUM NITRATE, Purified White Granular
AMMONIUM OXALATE, Purified Crystal
AMMONIUM SULFATE, Purified White Granular
AMMONIUM THIOCYANATE, Purified White Crystal
AMMONIUM THIOCYANATE, Technical White Crystal
ANTIMONY CHLORIDE (tri), Technical Crystals
(ANTU) ALPHA-NAPTHYL THIOUREA
BENZENE HEXACHLORIDE TECH.
BENZYL BENZOATE
BISMUTH NITRATE, Purified Crystal
BROMINE, Technical
CADMIUM CHLORIDE, Purified Crystal
CALCIUM NITRATE, Tech. Crystal
CARBON DISULFIDE, C.P. (Bisulfide)
CARBON DISULFIDE, Technical
CARBON TETRACHLORIDE, C.P.
CHLOROFORM, U.S.P.
CHLOROFORM TECH.
COBALT CHLORIDE, Technical Crystals
COBALT NITRATE, Technical Crystals
COBALTIC OXIDE, C.P., Black Powder
COPPER CHLORIDE, Purif. Crystal
CUPROUS CHLORIDE, Tech. Powder
COPPER NITRATE, (ic) Technical Granular
CREAM OF TARTAR, U.S.P. Powder
DDT (Dichloro-Diphenyl-Trichloroethane)
2,4-D ACID, (Dichlorophenoxyacetic Acid)
2,4-D SODIUM SALT (Sodium Salt of Dichlorophenoxyacetic Acid)
DEXTROSE, U.S.P. Granular
ELECTRONIC CHEMICALS
ETHER PETROLEUM, C.P. 35-60°
IODINE, U.S.P., Resublimed
IRON, N.F., Reduced by Hydrogen
ISOPROPYL N-PHENYL CARBAMATE TECH.
LEAD ACETATE, Technical White Broken
LEAD ACETATE, Technical Granular or Powder
LEAD CHLORIDE, Technical Crystal
LEAD NITRATE, 99-100% Purified Crystal
LEAD NITRATE, Technical
LEAD PEROXIDE, Technical 90% Powder
LEAD THIOCYANATE
LITHIUM FLUORIDE C.P., Powder
MAGNESIUM CARBONATE, U.S.P., Light Powder
MAGNESIUM CARBONATE, Technical Light Powder
MAGNESIUM OXIDE, U.S.P., Light Powder
MAGNESIUM OXIDE, Neoprene Grade
MERCURY CHLORIDE, N.F., Powder
MERCURIC NITRATE, Purified Crystal
MERCURIC OXIDE, Technical Yellow
MERCURIC SULFATE, Purified
MERCUROUS SULFATE, Technical
METHYL SALICYLATE, U.S.P., Liquid
PHOSPHORIC, Anhydride (Phosphorous Pentoxide) Powder
POTASSIUM ACETATE, U.S.P., Granular
POTASSIUM BROMATE, Purified Powder
POTASSIUM BROMIDE, U.S.P., Crystal or Granular
POTASSIUM CHLORIDE, C.P., Crystal
POTASSIUM CHLORIDE, U.S.P., Crystal
POTASSIUM CHLORIDE, Double Refined Crystal
POTASSIUM CHROMATE, Yellow Purified Crystal
POTASSIUM HYDROXIDE, U.S.P., Pellets
POTASSIUM HYDROXIDE, U.S.P., Sticks
POTASSIUM IODATE, Purif. Crystal, Granular or Powder
POTASSIUM IODIDE, U.S.P., Crystal, Granular or Powder
POTASSIUM IODIDE, 90%, with 10% of either Stearate or Calcium Carbonate
POTASSIUM PERSULFATE, Purified Powder
POTASSIUM SODIUM TARTRATE (Rochelle Salt, U.S.P. Powder)
POTASSIUM SULFATE, Double Refined
POTASSIUM SULFATE, N.F., Powder
POTASSIUM THIOCYANATE, Technical Crystal
RADIO CHEMICALS, Cathode Spray
SODIUM ACETATE, N.F., Granular
SODIUM BENZOATE, U.S.P., Powder
SODIUM BROMIDE, U.S.P. Granular
SODIUM CHLORIDE, C.P., Fine Crystal
SODIUM CHLORIDE, U.S.P., Granular
SODIUM HYDROXIDE, U.S.P., Pellets
SODIUM HYDROXIDE, U.S.P., Sticks
SODIUM IODIDE, U.S.P.
SODIUM MOLYBDATE, Technical Anhydrous
SODIUM OXALATE, Technical Powder
SODIUM SULFIDE, Purified Crystal
SODIUM THIOCYANATE, N.F., Crystals
SODIUM THIOCYANATE, Tech. Crystal 97-98%
SODIUM TUNGSTATE, Technical Crystals
STRONTIUM BROMIDE, N.F., Crystal
TIN CRYSTALS, (Stannous Chloride)
URANIUM, SALTS OF
ZINC ACETATE, N.F., Crystals
ZINC ACETATE, Technical Crystal
ZINC NITRATE, Technical
ZINC SULFATE, Purified Dried

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C. P. ANALYZED • FINE • INDUSTRIAL

# DIAMOND *Liquid Chlorine*

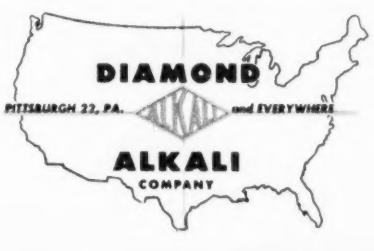
**furnished in cylinders**

multi-unit cars, or

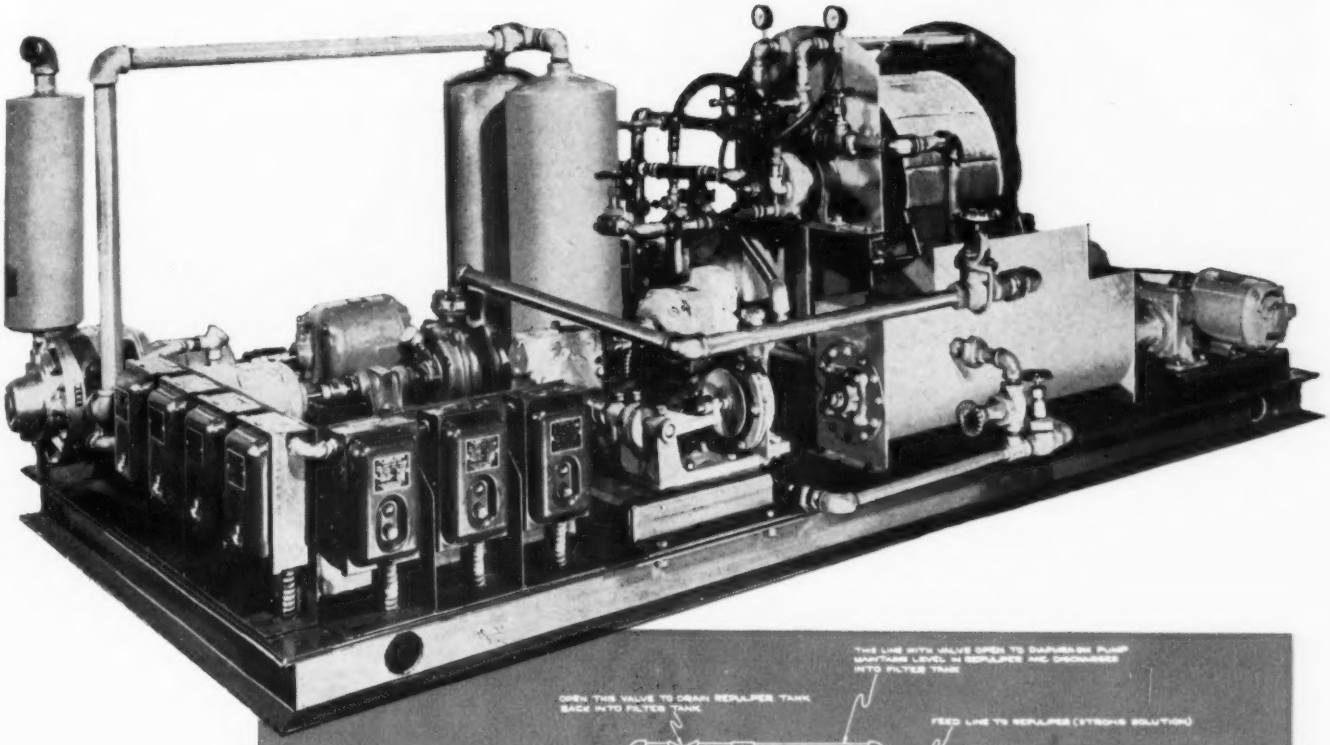
tank cars, to meet

your requirements

CHLORINE



# Eimco Laboratory Type Continuous Vacuum Filter



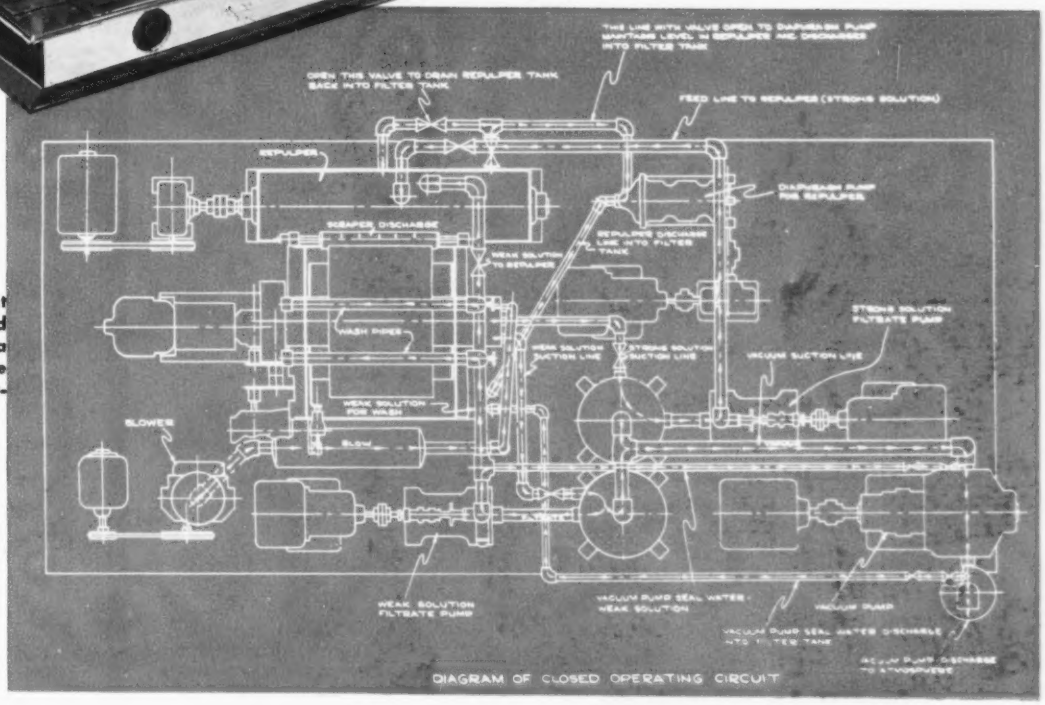


DIAGRAM OF CLOSED OPERATING CIRCUIT

The flow sheet shown at right is for the unit pictured above and shows how a laboratory unit may be piped for closed circuit operation.

**Eimco Laboratory type continuous vacuum filters are available for either single or double solution process work, completely set up with all necessary equipment mounted on a subbase, as shown, or as bare units. These units are available as either drum or disc type units and may be used with or without the wash frame, flapper and scoring device.**

**Write for bulletin F2004 on Laboratory units.**

**EIMCO**

THE EIMCO CORPORATION

**Executive Offices and Factories: Salt Lake City 8, Utah: Branches — 67 Wall St., New York 5 — 3319 So. Wallace St., Chicago 16 — Mills Bldg., El Paso — 1217 - 7th St., Sacramento 14 Birmingham 9, Alabama — 110 Malaga** A164.

Eimco production size Continuous Vacuum Filters for Metallurgical, Food, Chemical, Starch, Beet Sugar, Cane Sugar, Cement, and Flue Dust processes, Coal Dewatering, Salt and Sand Drying and Sewage Sludge Dewatering. Filters made to process the customer's product.

Research work on the silicofluorides is constantly in progress at The Davison Laboratories. Production processes are being improved . . . new applications developed . . . industrial problems are being solved.

This experience is at your service. The benefits resulting from the technological skill that perfected the "free-flowing" characteristic of Davison silicofluorides can be yours.

If your manufacturing processes require any of the silicofluoride properties in the adjoining list . . . you are invited to consult Davison.

THE DAVISON CHEMICAL CORPORATION

*Progress Through Chemistry*

BALTIMORE-3, MD.

PRIMARY PRODUCERS OF SILICOFLUORIDES

## GENERAL PROPERTIES OF SILICOFLUORIDES AND HOW THEY MAY BE UTILIZED

•

### WEAK ACID PROPERTIES

Silicofluorides are valuable as neutralizers and fixing agents; for pH control and polymerization.

### PRESERVATIVE PROPERTIES

Silicofluorides are anti-biotic, anti-fermentive and antiseptic. They are used in the control of mold, mildew and algae. Also as disinfectants, fungicides, germicides and insecticides.

### FLUXING PROPERTIES

Silicofluorides find wide application in such diversified fields as ceramics, porcelain enamels and enamel glazes, glass and vitreous enamel ware, metal refining, casting and welding.

### MORE TO COME

The above can only be a partial list of the present numerous applications of silicofluorides, and there are many yet to be developed through Davison's program of Progress Through Chemistry.

# Flame Resistant

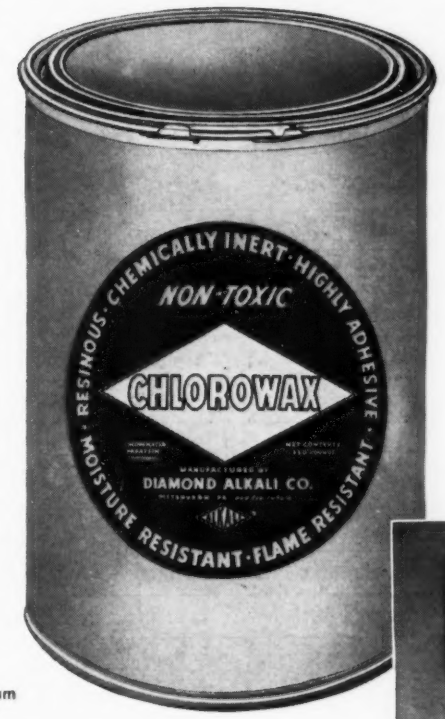
## DIAMOND

# *CHLOROWAX

## RESINOUS CHLORINATED PARAFFIN

Chlorowax—the Diamond chlorinated plastic—when combined with proper pigments, provides a protective coating, which retards combustion of the surface to which it is applied. Thus, Chlorowax gives a flame resistant quality to paints, textile coatings, paper coatings, etc.

Chlorowax is widely compatible with resins, rubbers, vegetable oils, natural waxes, and improves vapor resistance of some resins.




Contents of Drum
250 lbs.

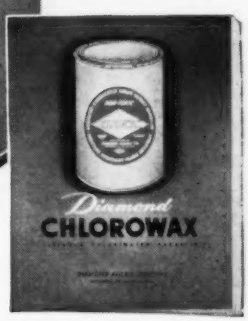
CHEMICALLY INERT

HIGHLY ADHESIVE

NON-TOXIC

**A few Suggested Uses:**

Interior and exterior paints—varnishes and lacquers—textile coatings—wood impregnation—polishes—floor coverings—glues and adhesives—paper coatings—printing inks, etc.



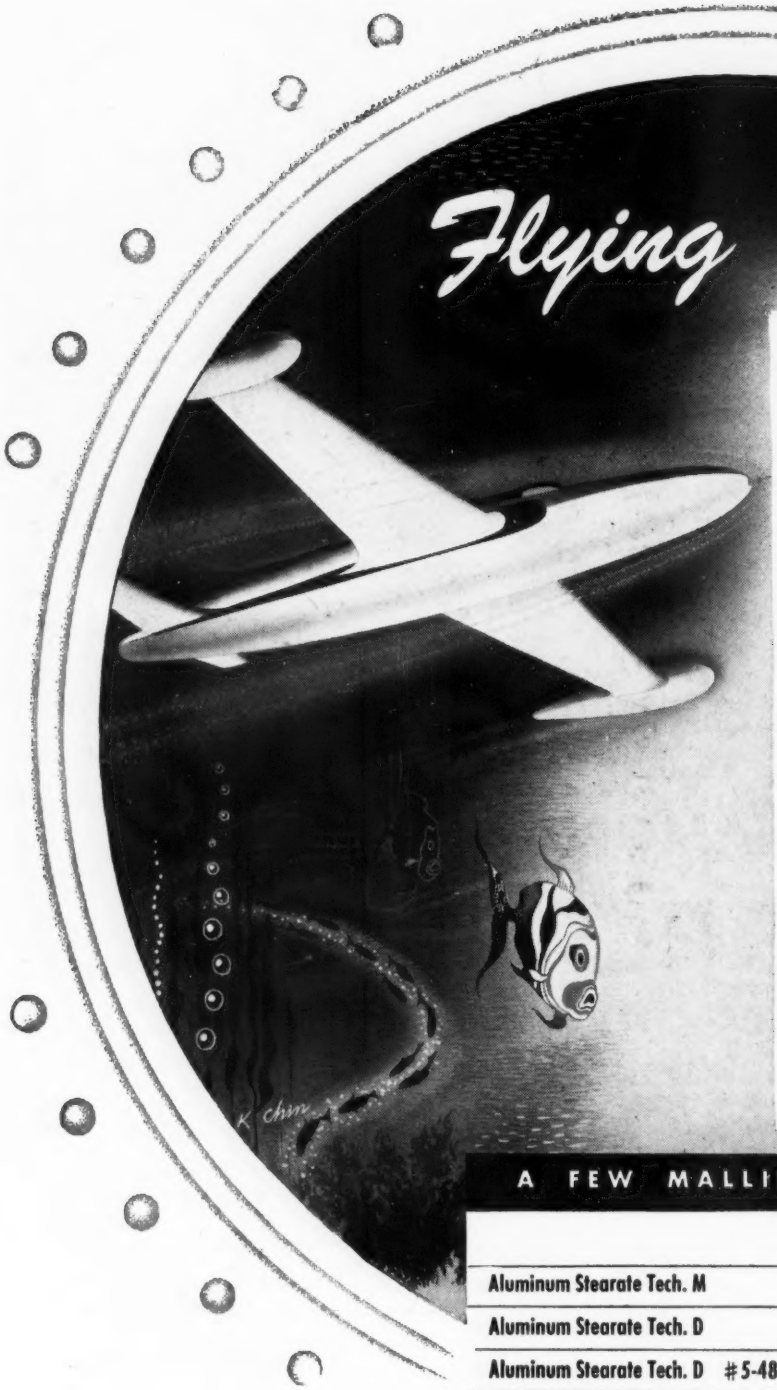

*Send for Booklet Today!*

This revised bulletin gives chemical and physical properties, solvents, compatibility and other pertinent data about Chlorowax and its many uses. Write for your copy today.

**DIAMOND ALKALI CO.**

**PITTSBURGH 22, PA.** *and Everywhere*

* Reg. U. S. Pat. Office



# *Flying* UNDER WATER

Aircraft engineers have actually towed full scale airplanes under water—several fathoms down—in their search for better design and construction. Low speed in water was used to simulate high speed in air. Records automatically made of stresses and strains during the tests located weaknesses in the plane. Genius of the aircraft industry in developing punishing and revealing tests and in building its product to meet them are the foundation of its success.

Less spectacular but equally searching are the many tests which **Mallinckrodt stearates** meet. Superior, too, are the products developed by this constant searching for weakness, this constant striving toward perfection.

Valuable in a variety of applications—gelling, coating, lubricating, releasing and repelling moisture—**Mallinckrodt stearates** are made to exacting specifications. Uniform dependable purity characterizes each type and grade.

## A FEW MALLINCKRODT STEARATES

| | BULK | METALLIC OXIDE | ACETONE EXTRACTABLE | MELTING POINT |
|---|---|---|---|---|
| Aluminum Stearate Tech. M | 50-55 ft. oz./lb. | 14-15% | 6.6-7.5% | 190-200° C |
| Aluminum Stearate Tech. D | 50-55 | 8.4-8.7 | 6-7 | 155-160 |
| Aluminum Stearate Tech. D #5-48 | 45-50 | 8.7-8.9 | 6-7 | 155-160 |
| Flatting Agent No. 22 | 60-65 | 8.4-8.7 | 9-10 | 145-150 |
| Aluminum Stearate Fluffy | 60-65 | 8.4-8.7 | 6-7 | 145-150 |
| Aluminum Stearate Tech. TD | 85-95 | 7.5-8.0 | 12.5-13.5 | 125-130 |
| Aluminum Stearate Tech. T | 60-65 | 6.0-6.5 | 24-25 | 105-110 |
| Ammonium Stearate Tech. | 30-35 | ----- | decomposes | decomposes |
| Calcium Stearate Impalpable Powd. Gr. A | 130-150 | 8.8-9.3 | 0.5-1.0 | 145-150 |
| Calcium Stearate Tech. Bulky Gr. A | 130-150 | 8.8-9.3 | 0.5-2.5 | 145-150 |
| Magnesium Stearate Impalp. Powd. Gr. A | 115-130 | 7.5-8.0 | 0.5-1.0 | 125-130 |
| Sodium Stearate Tech. Grade A | 35-40 | 9.5-10.5 | ----- | 175-180 |
| Zinc Stearate Tech. | 130-150 | 13-14 | 1-2 | 112-117 |
| Zinc Stearate U.S.P. XIII Grade A | 130-150 | 13-14 | 1-2 | 112-117 |

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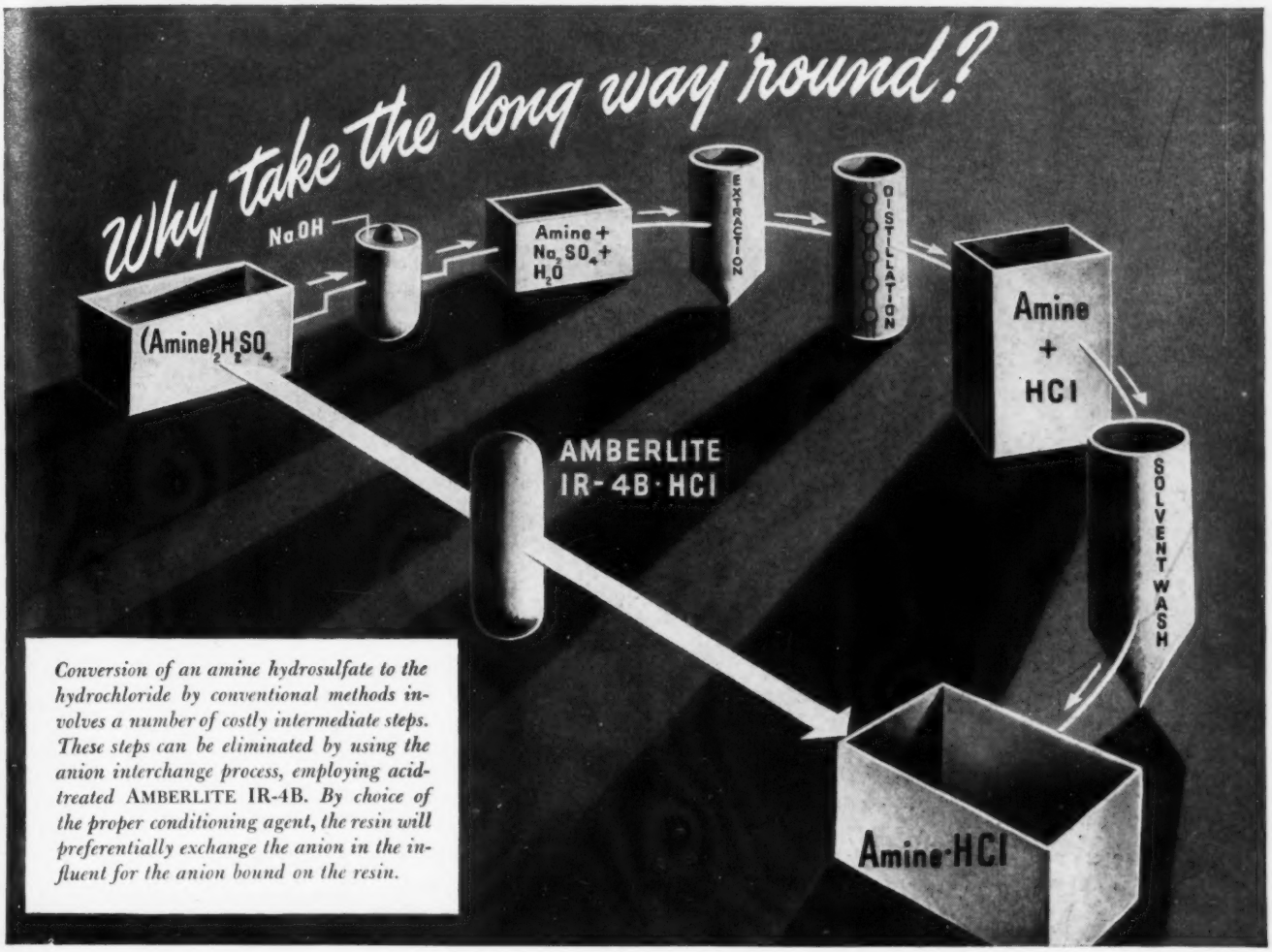



*Conversion of an amine hydrosulfate to the hydrochloride by conventional methods involves a number of costly intermediate steps. These steps can be eliminated by using the anion interchange process, employing acid-treated* AMBERLITE IR-4B. *By choice of the proper conditioning agent, the resin will preferentially exchange the anion in the influent for the anion bound on the resin.*

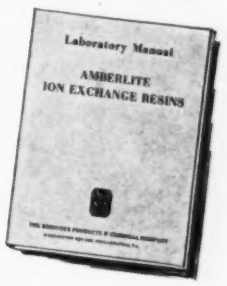
# Anion interchange with the Amberlite Ion Exchange Resins

In many a chemical process, extra steps can be eliminated . . . time and money saved . . . product quality and uniformity improved—through the use of the AMBERLITES in anion interchange.

Well-known for their ability to control water quality, the AMBERLITE Ion Exchange Resins are of equal interest in such varied fields as the recovery of valuable materials from wastes; the purification of pharmaceutical and fine chemicals; the isolation of organic bases.

Whether your interests lie in special chemical processes—or in the softening or complete deionization of water—you'll want to investigate the AMBERLITES. Our technical staff is always ready to discuss potential applications.

**Plenty of ideas for you Here**




*Want to know more about the* AMBERLITES, *and the ways in which they may be used in your industry? You'll find plenty of ideas, to spark your thinking, in our "Laboratory Manual, AMBERLITE Ion Exchange Resins". For your copy, write The Resinous Products & Chemical Company, Dept. CE4, Washington Square, Philadelphia 5, Pa.*

AMBERLITE *is a trade-mark, Reg. U. S. Pat. Off.*

## THE RESINOUS PRODUCTS & CHEMICAL COMPANY

*WASHINGTON SQUARE, PHILADELPHIA 5, PA.*

HOW HERCULES *Creative Chemistry*

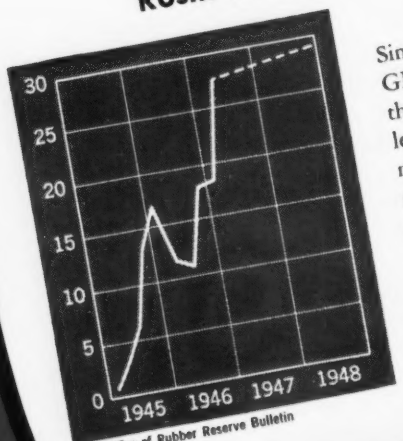
INTRODUCING . . .

# ROSIN AMINE D

| TYPICAL PHYSICAL PROPERTIES | |
|---|---|
| Physical State | Viscous yellow liquid |
| Color | Pale Yellow |
| Density @ 25°C | 0.997 |
| Refractive Index @ 20°C | 1.5410 |
| Nitrogen Content | 4.2 – 4.5% |
| Bromine Number ($KBr$-$KBrO_3$) | 49 |
| Viscosity @ 25°C | 4670 Centistokes |
| Boiling Range (5 mm.) | 187 – 211°C. |
| Boiling Range (100 mm.) | 270 – 291°C. |
| Boiling Range (760 mm.) | 344°C. (Partial Decomposition) |
| Flash Point (Cleveland Open Cup) | 192°C. |
| Heat of Vaporization | 20,100 calories per mole |
| Neutralization Equivalent | 317 |

Here's a new high-molecular weight, liquid primary amine derived by Hercules chemists from rosin. Although still in the pilot plant stage, and not yet available commercially, promising new uses for it are constantly being reported. Rosin Amine D is a pale yellow, viscous liquid that exhibits certain surface-active, fungicidal, and bactericidal properties, along with the chemical attributes of other primary amines. Typical physical properties are shown at the left. Rosin Amine D is now available for your laboratory and pilot plant evaluation.

## Rosin Rubber Hits New High

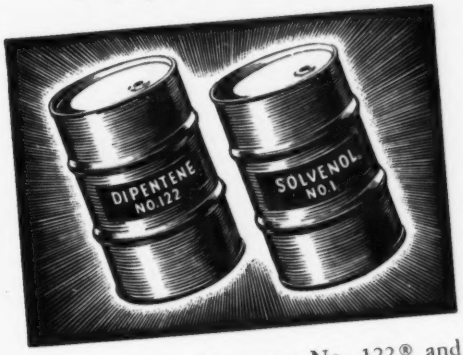



From Office of Rubber Reserve Bulletin

Since early 1945, the production of GR-S-10 and other rosin-type synthetic rubbers has increased from less than one per cent to approximately 30 per cent of the entire synthetic rubber output. The added toughness and wear resistance of rosin-type rubbers have, undoubtedly, been responsible for this increase. Hercules Dresinate 731 is the essential emulsifier for these rubbers.

# HELPS THE PROCESS INDUSTRIES (No. 2 of a Series)

## 2 Superior Solvents

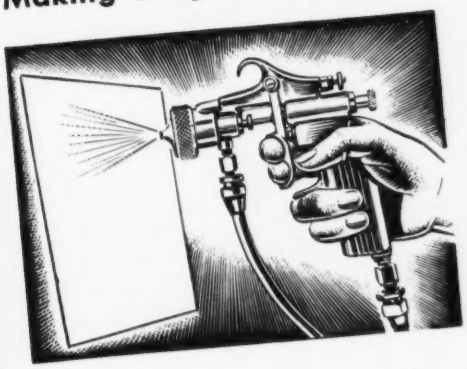



Now, Hercules Dipentene No. 122® and Solvenol No. 1® are again available for unrestricted delivery. Used with resins commonly employed in varnish and enamel production, these terpene solvents improve levelling and flow, and add distinct wetting properties. They also act as anti-skinning agents and promote uniform drying rate. They are best used as first thinners in hot varnishes.

## Aids Detergency

Introduced commercially only a year ago, Hercules® CMC (sodium carboxymethylcellulose or cellulose gum) already has found wide use in many industries. With the newer detergents, for example, CMC acts as a suspending agent, giving such detergents a colloidal property similar to that of soap. CMC suspends dirt, prevents its redeposit; thus improving cleansing action.

## Making Lacquer Even Better



Hercules Cellolyn® resins now provide the coatings industry with a family of resins specifically designed for lacquer. Available in types to meet specific needs, these tailor-made products are pale, with a moderately high melting point. In lacquers, they increase resistance to sunlight, low temperatures, and alcohol, and permit quick sanding, without increasing drying time.

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*Wide Range*

**Used in Polishes, Printing Inks, Crayons, Carbon Papers, Plastics, Rubber Mixes, Paints, etc.**

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ABRIL X

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(M.P. 120°C)

ABRIL 10 D S
(M.P. 140°C)

ABRIL B P B
(M.P. 170°C)

**Used in Cosmetics, Cream Polishes, Emulsions of all kinds.**

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ABRIL B J

ABRIL N D

ABRIL J W

★ Also ABRIL Emulsifying Agents, interesting for both O/W and W/O dispersions.

★ A further range of special products in preparation.

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# U.S.I. CHEMICAL NEWS

February ★ A Monthly Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1948

## *Amino Acids Seen as Aid to Thyroid Therapy*

According to recent animal experiments, some of the deleterious physiological reactions resulting from excessive use of thyroid hormone have been minimized by the administration of sulphur-containing amino acids. Methionine was found to be the most effective of these amino acids. This compound is now available in large quantities at a new reduced price.

# New Field Tests Indicate High Effectiveness Of U.S.I. Insect Repellents

### *Studies Conducted by Institute of Parasitology Show Superior Results for Triple Mix Repellents, Dimelone and Indalone Mixtures*

Throughout the summer of 1947, a group of investigators from the Canadian Institute of Parasitology tested the effectiveness of 31 recognized insect repellents under actual field conditions at Canada's Laurentides National Park. Subjects of the tests were a construction company's work crew. Members of the crew, living outdoors for about 22 hours each day, were ideal targets for predatory insects abounding in this area. When final results were compiled, U.S.I. insect repellents, based on Indalone and Dimelone ranked highest in protection to these men.

It was found, for example, that a combination of 25 per cent Indalone (reg. trade mark) and 75 per cent dimethyl phthalate was much superior to uncombined dimethyl phthalate. It provided an average protection time against black flies of about 8 hours. A combination of Indalone with Dimelone (reg. trade mark) in the ratio of 1 to 3 proved to be a "very satisfactory repellent." Dimelone when combined with dimethyl phthalate in the ratio of 3 to 7, gave protection for as long as 8 hours.

**To avoid the attacks of biting insects, U.S.I. insectifuge materials—Indalone, Dimelone and Triple Mix Repellents—have proved exceptionally effective in field tests conducted in a Canadian national park.**

#### Triple Mix Potency Proven

U.S.I.'s famous Triple Mix Repellent, was tested in two forms, as the pure liquid and in cream. "Very satisfactory" results were obtained—average protection against black flies and Tabanids lasting at least 5 hours. Triple Mix Repellent contains 6 parts by weight of dimethyl phthalate, 2 parts of Indalone, and 2 parts of Dimelone. U.S.I.'s 6-2-2 and the

MORE

# Oxygenated Chemicals Are Top Products From American Hydrocarbon Synthesis

**SECOND OF A SERIES**

*Because of the interest aroused in the Fischer-Tropsch Process by the announcement in these pages that U.S.I. would market the chemical output of the first Fischer-Tropsch plants in this country, a series of articles on this important chemical development have been prepared by the editors of Chemical News. The first of these, which appeared in the January issue, discussed the origin of the synthesis and the men who invented it. The current article describes other processes using raw materials from the Fischer-Tropsch synthesis.*

### *Germans Stressed Fuels, Oils From Fischer-Tropsch Process, Not Chemicals*

Impetus behind the development of the German Fischer-Tropsch synthesis was the urgent need for self-sufficiency in motor fuels and oils. So engrossed were German scientists and engineers in meeting this demand that emphasis was never placed on obtaining chemical raw materials directly from the process. Catalysts and operating conditions were selected to yield gasoline, diesel oil, and lubricants—rather than alcohols, aldehydes, ketones and acids. This prepossession in favor of hydrocarbons by the Germans resulted in failure to capitalize on chemicals from the synthesis.

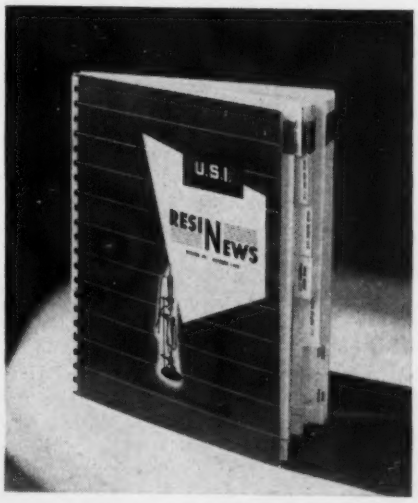
#### Germans Extended Fischer-Tropsch Process

Other pressing requirements in the German economy resulted in chemicals from the Fischer-Tropsch Process even if they were not directly produced in this original synthesis. It was found that a carbon monoxide molecule could be added to double bonds in unsaturated synthetic hydrocarbons to make aldehydes. This became known as the "Oxo" process. In a subsequent step, these aldehydes were hydrogenated to make primary alcohols.

A fatty acid process, the result of much German research, became fruitful when synthetic waxes from Fischer-Tropsch synthesis became available. The waxes were blown

MORE

## New Resin Book Is Most Comprehensive Since War




U. S. Industrial Chemicals, Inc., has released the first comprehensive edition of U.S.I. "Resinews" prepared since the war.

Although some of the basic raw materials for resins are still in short supply, U.S.I. points out that a number of them are once again available. This condition has permitted the company to return to the manufacture of many of its prewar resins. These, as well as the resins developed during the war years, are included in "Resinews."

Copies have already been distributed to the protective coatings industry.

## *New Glass Said to Resist Hydrofluoric Acid Attacks*

A radically new type of glass which contains no sand is alleged to resist the corrosive attacks of hydrofluoric acid and uranium pentoxide. Major ingredient of this glass is phosphorus pentoxide, the manufacturer states. Previously, the use of hydrofluoric acid presented difficulties because it could be shipped only in lead or wax containers, while in the laboratory it had to be processed in platinum or gold retorts which prevented visual observation of chemical reactions. Potential uses for the new glass include test tubes, beakers, bottles, evaporating dishes and other containers as well as safety goggles and helmets.

ADVERTISEMENT—*This entire page is a paid advertisement*

February ★ **U.S.I. CHEMICAL NEWS** ★ 1948

## CONTINUED Insect Repellents

1-3 combination of U.S.I.'s Indalone and Dimelone were the most satisfactory of all repellents tested, according to the report.

### Indalone and Dimelone

Indalone (*n*-butyl 6, 6-dimethyl-5, 6-dihydro-1, 4-pyrone-2-carboxylate), which had been developed by U.S.I. prior to the last war, was the first safe and successful repellent to be used by the Armed Forces. It is a light yellow to reddish brown liquid with a mild odor and a specific gravity of 1.056 to 1.062.

Dimelone (dimethyl *cis*-bicyclo [2.2.1]-5-heptene-2,3-dicarboxylate) is a water-white crystalline solid, melting point about 40 degrees C. It has a mild and pleasant odor and is soluble in Indalone and dimethyl phthalate.

It is a matter of pride to U.S.I. that of the extraordinarily small number of insect repellent materials which met the difficult war-time requirements of the Armed Services, two of the most successful—Indalone and Dimelone—should have been made by U.S.I.

### Supplies on Hand

U.S.I. now supplies Indalone, Dimelone, and Triple Mix Repellent Liquid. The company also lists a Triple Mix Repellent Cream, containing 92.5 per cent of the 6-2-2 liquid mixture. All these materials are available in bulk to repellent manufacturers only.

## *Devises New Method For Cosmetic Color Control*

A method for controlling colors of cosmetic powders, claimed to be more practicable than existing methods, was described recently before a meeting of an American scientific society. A line of face powders, the inventor explained, may include 20 shades, all within the narrow range of "flesh." This poses an exacting problem for the control chemist.

In the new procedure, the standards are made up of white papers, coated with a thin paste composed of a powder in a rapidly-drying nail lacquer of known composition. A special apparatus has been devised to coat the papers to a uniform thickness. The standard paper strips are compared with unknowns in a newly invented optical chamber.

## Alcohol Is Ingredient Of New Trench Mouth Solution

According to an item in an American medical journal a treatment for trench mouth consists of irrigating the affected area with hydrogen peroxide, drying it with cotton, and soaking the area with a dye solution. The solution is described as containing crystal violet, brilliant green, alcohol, and water.

## CONTINUED Oxygenated Chemicals

with air in the presence of a catalyst and the resulting acids applied to a variety of uses. One important use was a raw material in the Palatinol Process in which the acids were esterified with "Oxo Process" alcohols and other alcohols to make high boiling solvents and plasticizers.

### Margarine From Coal

A unique application of well known chemistry was the "Edible Fats" process. Had it been initiated in this country, its advertisers would have publicized it as "Margarine from Coal." A purified fraction of synthetic fatty acids, eight to twenty carbon atoms in length, was reacted with synthetic glycerin to yield glycerides or fats similar to the oils in butter or oleomargarine. Glycerine was obtained synthetically by the chlorination of propylene, obtained in hydrocarbon synthesis, using the same process as developed in this country. The purified fats were emulsified in enough water to produce a butter consistency, color and vitamins added and the product distributed to German tables. In taste, appearance and utility it resembled margarine made here. Chemically it was very similar.

### American Process

But the above examples are extensions to the Fischer-Tropsch Process, not part of it. The Hydrocarbon Synthesis Process from which U.S.I. will market the water-soluble oxygenated chemicals, will produce alcohols, aldehydes, ketones and acids directly. In addition, because of American engineering, it will incorporate vast improvements which will produce chemicals at costs competitive with those from other sources. With these materials, U.S.I. can increase its already extensive service to the chemical industry.

## TECHNICAL DEVELOPMENTS

*Further information regarding the manufacturers of these items may be obtained by writing U.S.I.*

**For proper floor finishing and maintenance,** a compact slide-rule guide has been made available which is said to supply information on the proper finishing materials and application methods for all types of floors. **(No. 285)**

**A portable hydrogenation unit** is described as compact and completely mobile, and is probably the first of its type to be marketed commercially. **(No. 286)**

**Data on material handling** are contained in a new directory said to be the first compendium of material handling equipment ever published. **(No. 287)**

**A glass that conducts electricity** is said to be fully transparent and may be heated to almost any desired temperature. **(No. 288)**

**A microscope no larger than a fountain pen** is adjustable to give 40, 50 or 60 power self-illuminating magnification, the makers state. It is said to be useful in examining minute detail in shop, office, or laboratory. **(No. 289)**

**A stain-, scar-, and flame-resistant flooring** is alleged to possess an excellent resilience, yet longer wearing qualities than rubber floor covering. Neither moisture nor alkalis will injure this material, it is stated. **(No. 290)**

**A "superstrong" industrial tape** is described as combining two materials: a fiberglas cloth backing having exceptional strength and resistance to deterioration, and a vulcanizable adhesive mass that more than doubles its strength after curing. **(No. 291)**

**Silica powder of microscopic fineness** and high purity is claimed to form staple suspensions in water and in many organic liquids. Greater strength and improved pigment dispersion results, according to the manufacturer, when this powder is added to many plastic materials. **(No. 292)**

**A new line of foil wrappings,** said to be suitable for use on standard machines, is claimed to make strong heat seals and offer excellent protection against moisture, odors, and sunlight. **(No. 293)**

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# Chemical Industries

THE MAGAZINE OF THE CHEMICAL PROCESS INDUSTRIES

For Your Information:

Newsletter,
February, 1948.

Within the next few months you can expect to hear a good deal about glucuronic acid. Recent research indicates that the glucose-derived acid holds more than a little promise as a remedy for rheumatic diseases (e.g. arthritis, rheumatic fever). Corn Products Refining Co., which supplied laboratory lots of the chemical for clinical investigations, is already building a production unit at Argo, Ill. A potential market: upwards of 12 million people in the U. S. afflicted with arthritis.

Due to attract considerable attention is a new process, developed by Technical Enterprises, Inc., to spray-dry (rather than freeze-dry) penicillin. One company has just installed such a spray-drying unit to cut processing costs. It does not, however, operate under sterile conditions, can produce penicillin for oral or external use only. Now on the drafting board: equipment for spray-drying the antibiotic for intravenous use.

* * * * *

No official announcement has been made as yet, but the Du Pont Co. is pushing development work on chlorinated polythene. The chlorinated product has many of the properties of polyvinyl chloride, but requires no plasticizer. There are indications, too, that it will yield a film superior to polythene and possess electrical and aging properties better than those of the vinyls.

If you recall CI's story on the naphthalene -- ortho-xylene tussle (Second Wind For Phthalic, p. 763, May, '47) these developments will be of more than usual interest: Shell Chemical Co. is now marketing ortho-xylene, Standard Oil of New Jersey will make offerings soon. Sherwin-Williams Co. is also busy checking phthalic yields from the polymer (rich in dimethyl naphthalene) from hydroformer operations.

* * * * *

The new GR-S rubber obtained by polymerizing butadiene and styrene at low temperatures (zero to 40 deg. F.) is being hailed privately by those close to the development as the biggest thing in synthetic rubber since the industry's founding.

Preliminary tests have yielded astounding results, indicate tire tread performance "substantially" better than the best natural rubber. (One rating scale, based on laboratory "mileage", resistance to cracking and abrasion, and other factors, indicates as much as 40% improvement over natural.) It must be emphasized, however, that actual road tests, which may or may not bear out laboratory observations, will not be completed for a year or so.

Meanwhile, Rubber Reserve is equipping part of the GR-S plants at Baton Rouge

(operated by Copolymer Corp.) and Borger, Texas (operated by U. S. Rubber Co.) to produce about 18,000 tons a year of "cold rubber". Initial production is scheduled for next month. Cost of making the 40-degree polymer will run about a quarter of a cent per pound more than ordinary GR-S, the zero-degree type will carry a 1½¢ cost increment. Among the reaction chemicals the new process will require: cumene hydroperoxide, invert sugar, sodium pyrophosphate, and ferrous sulfate. Methanol is used in the butadiene-styrene-water emulsion as an anti-freeze.

If you are interested in the anti-freeze business, you may like to consider the 1948-49 season prognostications of a major, national anti-freeze distributor. Its estimate: of a total anticipated 70,000,000 gallon volume, ethylene glycol will capture a 23,000,000 gallon share, methanol, 22,000,000, and ethanol, 25,000,000.

* * * * *

Perhaps it highlights a trend toward consumer merchandising: The Pantasote Co., Passaic, N. J., which has heretofore made coated fabrics for sale to industry only, is planning an extensive retail selling campaign to introduce Lifewall, a vinyl-based wall covering. At present its plant is turning out the new item at a 150,000 square yard per month rate. Continental Soap Corp., Chicago, long a maker of industrial soaps, is also test marketing a household soap powder, tradenamed Fazt. National distribution is on the docket. Too, International Minerals and Chemical Corp.'s Amino Products Division is launching a liquid seasoning, tagged Pret, as a companion line for its flavor accentuator, Accent. Major attention is still being paid to commercial users (hotels, restaurants) but it is not improbable that the two items will develop into over-the-counter products.

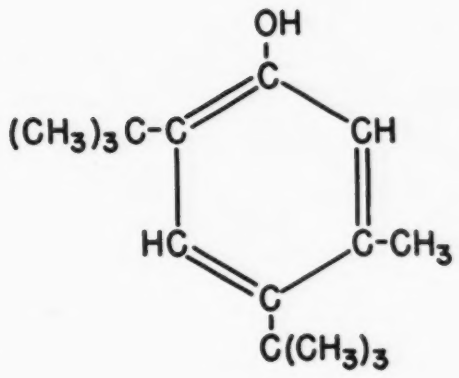
* * * * *

Here and There:

A prominent water-conditioning firm is conducting a careful survey to determine what effect burgeoning synthetic detergent sales may have on the future market for its water-softening chemicals ... Glass-Wax, a cleaner-polisher for glass and silver, sold for some months in Chicago (Marshall Field) will move into new territories this spring ... Dominion Tar & Chemical Co. Ltd., sole Canadian producer of phthalic anhydride, will bring in a new unit next month, expects to complete its $1 million expansion by October ... Sherwin-Williams Co., which discontinued its flat oil-paint line during the war, has decided not to reinstate it. Promotional effort will be placed behind Kem-Tone (emulsion type paint) for interior "flat" work ... Silicone "bouncing putty", long a novelty without a use, is about to enter two commercial products: U. S. Rubber will use the silicone as a golf ball core, Blake Industries, Detroit, will employ it in a gadget to adjust table-leg lengths (to prevent wobbling on uneven floors) ... Several top soapmakers, eyeing Lever Bros.' "Solium", are beaver-busy testing optical bleaches. One, at least, will feature such an additive within the next few months. Lever, incidentally, is contemplating another "ium" to spark Lifebuoy sales ... Shell Chemical Co. will bring in its new ethanol unit at Houston, Texas, during the second quarter of the year ... A new ion exchange resin for medicinal use will soon be introduced by a major resin maker. Although it is not for the treatment of gastric ulcers, its specific purpose is still being kept under wraps.

The Editors

# DBMC




# 4, 6-Di-tert-Butyl-meta-Cresol

**PROPERTIES OF THE PURE COMPOUND:**

| | |
|---|---|
| **FORM:** | White to light yellow crystals |
| **ODOR:** | Mildly phenolic |
| **EMPIRICAL FORMULA:** | $C_{15}H_{24}O$ |
| **MOLECULAR WEIGHT:** | 220.15 |
| **SPECIFIC GRAVITY (liquid, 80/4° C.):** | 0.912 |
| **MELTING POINT:** | 62.1° C. |
| **BOILING POINTS:** | 282° C at 760 mm<br>211° C at 100 mm<br>167° C at 20 mm |
| **SOLUBILITY:** | Soluble in ethanol, benzene, carbon tetrachloride, ethyl ether<br>Essentially insoluble in water and in 10% aqueous NaOH |

**APPLICATION:** Di-tert-Butyl-meta-Cresol is a tri-substituted phenol in which only one of the three normally reactive nuclear positions is available for further chemical reaction. This compound is suggested as an intermediate for the production of rubber chemicals, modified phenolic resins and synthetic musks of the ambrette type. It is also suggested for use as a tackifier and softener for GR-N type synthetic rubbers, and in the production of ebonites based on GR-N polymers.

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# LIGHTS AND SHADOWS IN OIL

*by* ***ROBERT L. TAYLOR, Editor***

BETWEEN WASHINGTON AND THE WEATHER, the oil shortage has been so much in the public spotlight during the past month that it has been rather hard for those unfamiliar with it to see the real picture for the glare. We have heard all manner of outcries, from calls for aid from families in temporarily heatless homes, to the sweeping assertion that as of now the United States is a have-not nation in oil and "what are we going to do about it?" From Washington, the Secretary of the Interior has called for the immediate starting of a $9,000,000,000 program to build a synthetic oil industry capable of supplying a third of our present needs.

So just what is the situation? We in the chemical industry have a right to know. Petroleum is our fastest-growing chemical raw material, and there are other ways, too, in which the paths and interests of these two great industries are converging.

***Basically, the picture is this:*** The United States is not, of course, "running out of oil." The current shortage of fuel oil is due principally to an abnormally severe winter, plus what seems to have been an unusually high rate of activity on the part of oil burner salesmen during recent years. The state of our petroleum reserves has had little, if anything, to do with the situation. Domestic consumption of all petroleum products in 1947 far outstripped consumption during even the peak years of the war, and the industry's production and refining facilities have simply been unable to keep up, despite large expansion programs.

The longer term outlook for U. S. oil is something entirely different, however. But even here the picture is not yet one of dwindling supplies. There is no indication that this country is going to "run out of oil" anytime in the next few years or even decades. Proved domestic reserves of crude have been going up virtually every year, and as exploration activities are increased they will doubtless continue to go up for some years to come.

But here is the crux of the situation. Despite the fact that reserves are still increasing faster than consumption, they are not increasing fast enough to provide the flow of oil necessary to meet mounting demand. The flow from a new well in the course of a year is usually only a small fraction of its reserve. Like interest on a bank account, it is necessary to increase the principal by a very large amount to get only a small increase in annual return.

This, basically, is the reason why the United States has had to turn to foreign sources to supplement its production of crude oil and why both the oil companies and the federal government are now investigating synthetic sources. In addition, geologically speaking, our total supply of oil actually is, of course, being depleted. Although the rate of discovery of new wells is being maintained, it is becoming necessary to go to greater depths and more inaccessible regions. This in itself tends to stimulate interest in other sources and to narrow the economic gap between crude petroleum and synthetic from shale, natural gas and coal.

***Is the Krug proposal the answer?*** The program urged by the Secretary of the Interior last month calls for construction of capacity over the next ten years to make two million barrels a day of synthetic liquid fuel at a capital outlay of nine billion dollars. The main consideration behind the proposal is obviously national security.

That is an important reason. But the magnitude of the project is somewhat staggering. The amount of construction required has been compared to that in ten synthetic rubber programs of the size undertaken during the war. A decision to launch any such mammoth undertaking should be preceded by careful and thoughtful study. There are many complex questions involved, such as the place of private producers, some of whom have already launched their own exploratory synthetic programs; the advisability of tying up so great an investment in processes whose technology is still developing very rapidly; and the relative effectiveness and cost of a synthetic industry as against stockpiling imported oil or, in case of an emergency, allocating domestic production to military uses and converting to coal for civilian needs.

There is no longer any disagreement on the point that the United States is going to have to depend increasingly on either foreign or synthetic sources for its liquid fuels. But before jumping into any gargantuan synthetic oil program it would seem that there should be a much more thorough study of the problems involved and possible alternatives than so far appears to have been made.

TWO KINDS of chemists work in our plants and laboratories. Many have doctor's degrees and look just like the rest of us. You can regularly find them at work on our customers' problems. Others are invisible—at least to the unaided eye. These latter are the various bacteria, yeasts, and molds which, no less than human chemists, are capable of manufacturing chemicals.

These two kinds of chemists illustrate the two ways in which Commercial Solvents products are made. The human chemists take natural gas, for instance, and by means of heat, pressure and catalysts rearrange its molecules to form formaldehyde, the nitroparaffins and the methanol which, made into antifreeze, protects the radiator of your car in winter. The microscopic "chemists" take grain or other carbohydrate materials and by fermentation convert them into alcohol, butanol, acetone, riboflavin and penicillin.

These two chemical processes, synthetic and biological, are used by Commercial Solvents to make chemicals. Through its knowledge and skill in both, CSC serves medicine, industry and agriculture.

COMMERCIAL SOLVENTS
*Corporation*
17 East 42nd Street, New York 17, N. Y.

# What's new

## SULFURIC: A RISING GLASS

**A million tons of new sulfuric acid capacity, added to the nine million existing tons, spells a continued high level of chemical output.**

FOR INDICATIONS of qualitative trends in the chemical industry—i.e., what new chemicals will be important, what raw materials will be in great demand—one looks to the research laboratories; but it is to the sulfuric acid industry—the universal foundation underlying all the ramifications of chemical production—that one turns, as to a barometer, for prognostications of quantitative chemical activity. No other single chemical commodity, perhaps, is so accurate a weathercock of the industrial climate; and no other construction, consequently, is so portentous of fair weather ahead as expansion of sulfuric acid capacity.

### Confident Acid-Makers

Thus it is reassuring, in the face of some economists' forecasts of an imminent recession, that sulfuric acid manufacturers are boosting capacity by a million tons. That figure represents construction finished or under way in 1947.

The 1946 postwar slack in output was taken up last year, and the trend still appears to be a gentle upward slope. Production in 1945 (excluding fortified spent acid) was 8,687,070 short tons of 100 per cent acid; the figure dropped in 1946 to 8,649,163 tons. But 1947 output, extrapolated from the first ten months' statistics, was about 9,900,000 tons—a 14 per cent increase over the preceding year.

### More Normal Than Actual

Actual capacity before expansion was over 10 million tons, about 10 per cent of which was obviously not used. But because sulfuric acid is inflexible in that it cannot be economically transported over long distances from manufacturer to user, and because of the tank-car shortage for short hauls, the excess capacity is more nominal than actual. The chamber plants in the Southeast can produce much closer to capacity than the contact plants because they are usually operated in connection with fertilizer plants; the acid is used on the spot to make superphosphate. Contact plants are generally larger and depend to a greater extent on outside customers; they are more vulnerable, therefore, to transportation difficulties.

### Where There's Industry, There's Sulfuric

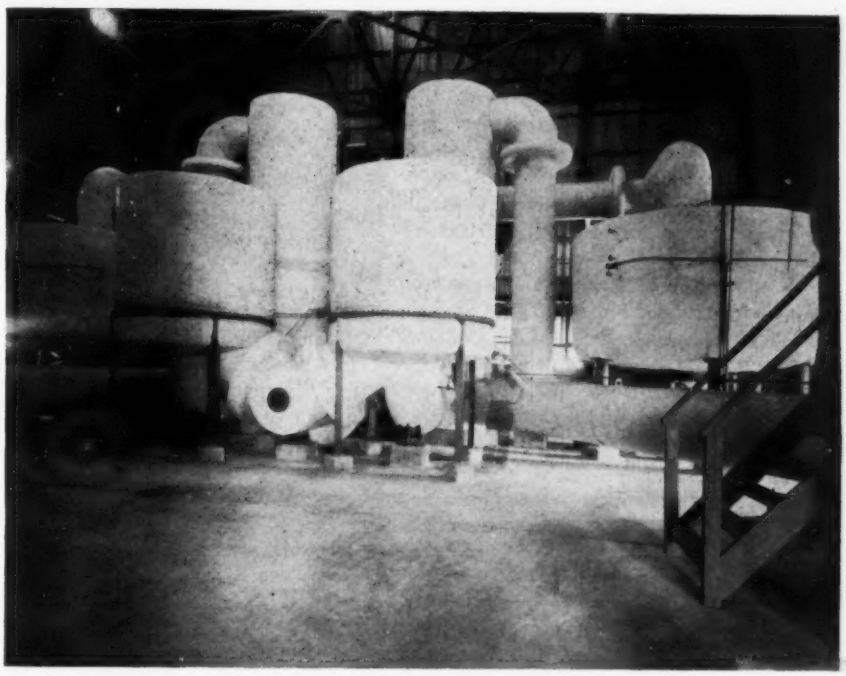
Almost half (47 per cent) of the acid is produced in the East; another quarter (26 per cent) is manufactured in the Middle West and Southwest; the Southeast accounts for 18 per cent, the West for 7 per cent; the remainder—less than 2 per cent—is produced in New England.

The predominance of the East is not difficult to explain: About a third of the total acid production is used in petroleum refining and chemical production; another third goes into other manufactures—iron and steel, coke, nonferrous metals, coatings, explosives, textiles, and cellulose—which are concentrated in the East. Middle Western industry and Southwestern oil account for the high production in those areas.

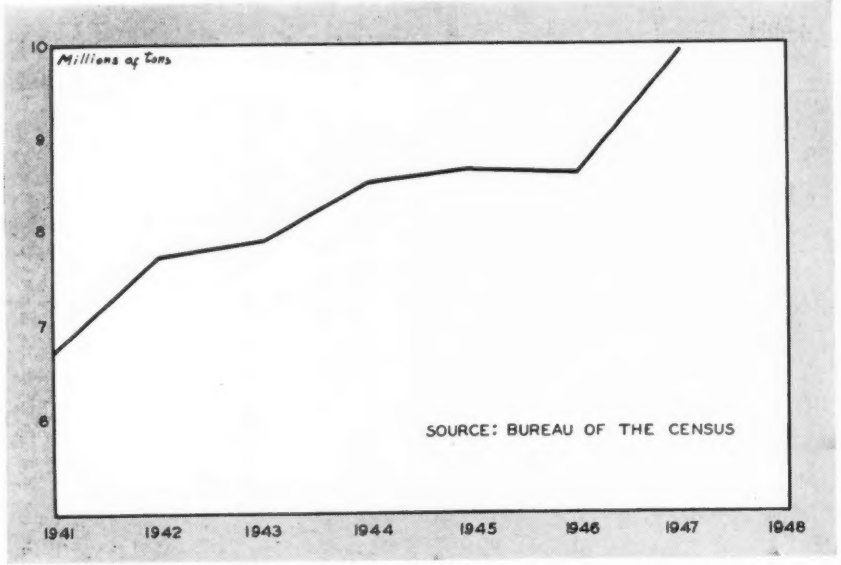
The final third—that used for fertilizer manufacture—explains the relatively high production in the agricultural South. The land in that region, farmed as intensively as it has been for over 300 years, was first to require fertilizer. Sulfuric plants were built early, and practically all of them still use the chamber process, which was current practice at the time of their construction. There are very few chamber plants, on the other hand, west of the Mississippi River, for they were built after the contact process was established. Current expansion is practically all of the latter types.

### Westward Trek

The geographical "center of gravity" of sulfuric manufacture, like the centers of population and industry, is shifting west-



CHEMICO CONTACT PLANT: When sulfur is burned, times are good.




**SULFURIC ACID OUTPUT: A rising glass betokens fair weather.**

ward. The industrial growth of all western sections of the country is one, but not a sufficient, reason: Increased emphasis on fertilizers bulks very large.

When lands are first brought under cultivation, little if any fertilizer is needed. Then, as the land is worked year after year, fertilizer materials first trickle, then pour into the area. Finally the demand is so large and constant that fertilizer plants are constructed. The South was the first region to experience that cycle. Many Middle Western lands are now well into the second phase, and the third phase is beginning to appear. High crop prices, moreover, mean higher fertilizer sales.

Several new producers are working the phosphate deposits in Idaho and Montana, and one established producer is reportedly building a new $5,000,000 plant. Phenol production on the West Coast, now being considered by several producers, will jump sulfuric requirements in that region. Not to be overlooked, either, is the growth of ammonia production in the Middle West. A good part of it may be converted, for reasons of convenience and safety, into ammonium sulfate. These are but some of the straws in the wind, pointing to a slow but steady westward drift of sulfuric's epicenter.

Much of the new expansion is going up in well-established centers: Virginia, Maryland, Ohio, South Carolina, and Pennsylvania. But a lot of plants are being erected in Illinois, Iowa, Indiana, Arkansas, Missouri, and Texas.

### Larger and Simpler

Both of the major plant designers and contractors, Leonard Construction Co. and Chemical Construction Co., report that design business this past year exceeded that of any of the peak war years.

The significant trend in construction is toward larger (100 tons per day and up) and simpler units. One company, it is rumored, may scrap its several small plants and build one large, more economical, unit.

One of the newest technical wrinkles in contact acid manufacture is to purify the brimstone by filtration. Sulfur is very pure at the mines, but it often picks up as much as 0.1 per cent fly ash during handling and storage at the customers' plants. In the new process the sulfur is simply melted and filtered before burning to prevent fly ash from entering the catalyst chamber. It obviates the more complicated gas filtration procedure used previously.

### Gamble on Prosperity

The present high rate of sulfuric consumption parallels general industrial activity. Expansion would not have been undertaken, certainly, unless over-all production were expected to go higher; and with prevailing construction costs, such expectations must be justified more persuasively than ever before. The sulfuric acid industry, then, is gambling on a continuously rising index of industrial production. Under the present circumstances, the odds on that gamble must look extremely favorable. Time will tell.

---

## ALLERGY BANE

A new synthetic compound called Histadyl combats the allergic reactions limiting the usefulness of many potent drugs. In the past, when a patient receiving regular doses of a drug suffered side reactions such as hives, it was necessary to halt the treatment. It has now been found possible to continue to give some patients penicillin, streptomycin, and other drugs to which they have become allergic by the concurrent administration of Histadyl.

Developed by Lilly Research Laboratories, Histadyl has been found useful in treating patients suffering from hay fever, food allergies and allergic headaches.

## LEADED VINYLS

**National Lead Company's series of lead-containing vinyl stabilizers enters plant stage.**

BACK IN the early days of vinyls, General Electric had a grim but enlightening experience. Some vinyl-clad wire which had been exposed out-of-doors looked fine; but inside, in place of the bright copper wire, was a green mess. The vinyl chloride had decomposed, giving off hydrochloric acid which attacked the copper.

The thing to do, it was thought in those days, was to add a substance that was basic and formed an insoluble chloride: viz. (remembering one's sophomore chemistry), silver, mercurous mercury, or lead. The first two are too expensive, so lead looked like the best bet.

Litharge was one of the first compounds tried; but it is not color-stable and plastics compounded with it darken upon exposure to light. White lead, being a carbonate, gives off carbon dioxide when it reacts with the HCl of decomposition. Both of these materials have been used, despite their failings, for compounding vinyls.

### Lead Salts Galore

Meanwhile, research men at National Lead Co.'s laboratory had prepared lead salts of every available acid in an effort to find new pigments and other profitable items to add to the product list. Now they were evaluated for vinyl stabilization and several promising ones turned up.

The first one was tribasic lead sulfate, $3PbO \cdot PbSO_4 \cdot H_2O$, sold as Tribase. This compound, containing 67 per cent basic lead oxide, is the most basic lead sulfate possible to produce—practically a "white litharge." Its basicity makes it especially useful in insulation materials.

### Preventive Medicine

Tribase, having a high refractive index, acts as an opaque pigment. Something was needed which had the same refractive index as the vinyls so that it would appear colorless in the plastic. A co- precipitated mixture of lead orthosilicate and silica gel was found to have the desired properties. Plumb-O-Sil A has the same refractive index as polyvinylidene chloride; Plumb-O-Sil B, the same as polyvinyl chloride.

These products were brought out about three years ago, and about that time opinions about the whys and wherefores of stabilization were undergoing drastic changes.

For one thing, it appeared that the insoluble-chloride idea was a myth. Carbide's dibutyl tin dilaurate, for example, is an excellent non-lead stabilizer. Also, it seemed logical to prevent vinyl decomposition rather than merely to neutralize the effects of such decomposition. Stabilization should be preventive rather than curative.

The answer, obviously, was something that absorbs ultraviolet light. Normal lead salicylate (Normasal) was found to do the trick; moreover, the phenolic structure confers anti-oxidant properties upon the compound. This is now in plant production.

### Pilot Plant Promise

Three other stabilizers are in the pilot plant, awaiting equipment and space for plant production:

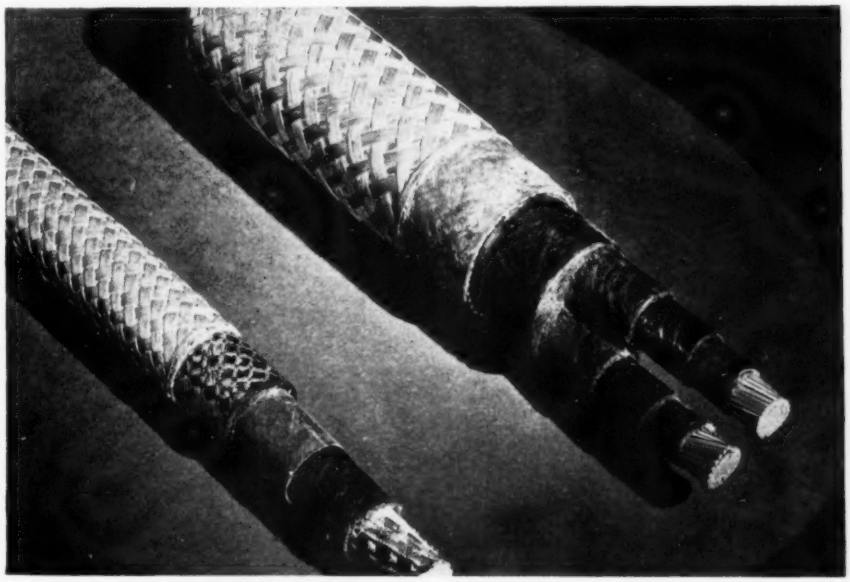
Dibasic lead stearate (DS207) gives clear plastics, confers heat and light stability, and doubles as a lubricant for molding, extruding, and related processes. Dibasic lead phthalate (Dythal) is basic enough to stabilize against heat and ultraviolet-absorptive enough to protect against light. In addition, it is compatible with dioctyl phthalate. Tribasic lead maleate (Tri-Mal) is as basic as Tribase and is structurally designed to absorb ultraviolet radiation. Still newer ones are in the laboratory stage.

Phonograph records are being pressed successfully from unplasticized vinyl containing a small proportion of DS207 as a stabilizer and mold lubricant.

### Vinyls Up, Stabilizers Follow

Since vinyls have proved to be among the more versatile plastics and their production has been steadily rising (see CI, November, 1947, p. 793), National Lead sees a profitable future for its stabilizers. Adding to the market is the fact that more and more vinyl is being used for out-of-doors applications, where light stability is indispensable.

Perhaps the perfect stabilizer—taking into account effectiveness, campatibility with formulations, transparency, etc.—will never be found. But research men are constantly searching; they are approaching closer and closer to the ultimate ideal.



**VINYL PLASTICS: It's better to prevent a breakdown.**

# WHITE DYE

**Call them optical bleaches or white dyes, these new materials substantially increase the brightness of white fabrics.**

"NEW! AMAZING! Contains Solium! This new Rinso washes white clothes WHITER *than new* . . . Makes washable colors look BRIGHTER *than new!! New Rinso is the only soap* that contains Solium, the amazing 'sunlight' ingredient."

Behind the rabid language of the advertising copy writer is a new chemical development which is making soap and textile people sit up and take notice.

### Jaundiced Fabrics

There's no getting around the fact that all of the commonly used textile fibers become slightly yellow upon exposure to the sun, or to dirt, or simply in the course of use. To counteract this jaundiced effect, bluing is a standard item on the laundry shelf.

It is true that the bluing, by absorbing light in one end of the spectrum, cancels out the yellowishness resulting from absorption by the cloth of the other end of the spectrum. But white is, by definition, "reflecting to the eye all the rays of the spectrum combined"; while black is "destitute of light, or incapable of reflecting."

Thus, the effect of these combined absorptions is to produce an intermediate shade of "tattle-tale gray."

### Addition Replaces Subtraction

These new materials, of which Lever Bros.' Solium is one example, operate on a different principle. They are actually colorless, blue-fluorescing dyestuffs. Some are stilbene derivatives, other triazines, still others modified umbelliferones. Regardless of their constitution, they all work on the same principle.

*Courtesy Colgate-Palmolive-Peet Co.*

**OPTICAL BLEACH: Packaged sunlight adds whiteness.**

Instead of absorbing visible light, as does bluing, they absorb ultraviolet radiation and re-emit the energy in the form of visible blue radiation. Thus, instead of subtracting from the total amount of reflection, they add to it. The yellowishness is canceled just as effectively, but the brightness level of the fabric is raised closer to pure white.

Why "dye" the soap instead of the fabric itself? Most dyestuffs men believe that the only suitable materials are not fast enough to light—not as fast, that is, as the colored dyes. Thus the brightening effect would be lost after the cloth had been in use for some time. The alternative is to use a fugitive dye and add it to the soap. It is absorbed by the fabric, where it works for a brief time—but before it's gone the cloth is dirty again and another washing renews the fluorescence. The dye must not be too lightfast for this mode of application, or it will build up during wash after wash until the wearer of garment glows in the sunlight like a Broadway marquee.

### Some Are Permanent

But not all dyestuffs men agree that there are no permanent optical bleaches; Geigy & Co., in fact, has one. Discharged onto textiles at the mill from the amazingly low concentration of 0.001 to 0.02 per cent in water solution, Geigy's Tinopal BVA is claimed to confer a permanent brightness on the fabric. The material behaves like a direct dye and is fast to alkali, dilute acid, metals (copper, lead, brass, bronze, zinc and stainless steel—not iron), chlorine, peroxide, hydrosulfites, steam, ironing, and—of course—ordinary washing.

Whether these materials are applied at the mill like dye or in the laundry like bluing, there seems to be no doubt, in trade opinion, that their future is assured.

After all, they add to "eye appeal," and eye appeal is one of the more potent sales arguments, especially for consumer goods.

Lever is shouting Rinso's Solium from the housetops. Its Lux and Proctor & Gamble's Duz also glow under an ultraviolet lamp, indicating that something new has been added; but no mention has been made in advertising or on the cartons themselves.

Other fields besides textiles are lying fallow, waiting for the plow. Optical bleaches could make white paper whiter, allow mills to use cheaper stock. Incorporated into white shoe dressings, they might neutralize the off-shades of white leather. These "sunlight" ingredients may well win an honored place wherever, in the modern emphasis on perfection, white should be even whiter.

McCARTHY AND COMPANY:* Dry gas and oxygen are the foundation.

# McCARTHY UNVEILS

**McCarthy Chemical will spend $15 million at Winnie, Texas, to produce formaldehyde, acetaldehyde, ethylene and benzene.**

USERS of acetaldehyde, formaldehyde and methanol can look forward to an additional source of supply late this summer or fall when these products begin to pour from the new $15,000,000 plant of the McCarthy Chemical Co. at Winnie (near Beaumont), Texas.

This plant will be unique. As noted in CHEMICAL INDUSTRIES Newsletter last June, it will be the first commercial chemical operation to utilize elemental oxygen for the production of chemicals from dry natural gas, i.e., natural gas from which all hydrocarbons except methane and ethane have been removed.

The McCarthy plant's output of formalin and acetaldehyde will approach 900,000 pounds per day at full capacity, which is approximately 30% of the total U. S. production of these materials in 1946.

It is also planned to install a slightly modified Cycloversion unit for the catalyctic treatment of natural gasoline. The Cycloversion process is licensed by the Perco Division of the Phillips Petroleum Co. It employs a natural bauxite catalyst in a fixed bed to accomplish a catalytic reforming of the natural gasoline. For the present the Cycloversion product will be combined with untreated gasoline to produce a high octane motor fuel, but, eventually, according to Joseph E. Bludworth, a McCarthy consultant, it is planned to utilize a portion of the product as a raw material stream for the production of aromatic hydrocarbons, such as benzene.

### Raw Material Source

The dry gas feed for the oxidation unit will be obtained from Absorption Plant, Inc., another McCarthy enterprise now operating a plant at Winnie. This plant can dry 100,000,000 cubic feet of raw gas per day, and it is planned to increase this capacity to 250,000,000 cubic feet per day by the latter part of 1948. In line with the trend towards increasing prices for low molecular weight hydracarbons, which CI has previously noted (CI, pg. 206, Aug. 1947), Mr. Bludworth states, ". . . due to the present high prices being offered for butane and propane, these are to be sold in their entirety as liquefied petroleum gases."

### Will Use Elemental Oxygen

In the use of elemental oxygen rather than air as its oxidizing agent, the McCarthy plant will differ markedly from the other two hydrocarbon oxidation units now in operation in the United States. The plant will make its own oxygen on the premises for conversion of dry natural gas into acetaldehyde, formaldehyde and methanol. The Celanese Corp. of America at Bishop, Texas, oxidizes butane and propane with air to produce a mixture of products, principally acetaldehyde and formaldehyde. At Tallant, Oklahoma, Cities Service Oil Co., the pioneer in petroleum hydrocarbon oxidation, utilizes air for the direct conversion of natural gas into formaldehyde, methanol, acetaldehyde and acetone.

* (l. to r.) Glenn McCarthy, Joseph E. Bludworth and George M. McGranahan.

### Largest Ethylene Plant

The first portion of the McCarthy plant to be completed will be the oxidation unit, with an ethylene unit to come later. The ethylene plant will reportedly be the largest in the United States and the company plans to produce all of its ethylene from the ethane fraction of its raw material gas. The ethylene is to be sold to one of several neighboring companies (see map) which are among the largest consumers of ethylene in the country.

According to Mr. Bludworth a new catalyst has been developed for the de-

WINNIE AND VICINITY: The neighborhood is congenial.

hydrogenation of ethane which reduces the amount of methane produced and increases the amount of ethylene. This catalyst will also allow the dehydrogenation reaction to be carried out at a much lower temperature than previously. Although a process has been developed by the McCarthy Company for the oxidation of ethylene to acetaldehyde and formaldehyde it does not plan to use it at the present time because of the ready and profitable market for the ethylene.

**Aromatics Later**

In addition to the oxidation unit and the ethylene plant, the company is planning a unit for production of aromatic hydrocarbons. The only aromatic that has been mentioned specifically is benzene, although reference has been made in recent publications to "other aromatic hydrocarbons."

Earlier reports (CI, page 404, March 1947) mentioned styrene as a possibility. At that time McCarthy had submitted a bid for the government styrene plant at Texas City, Texas, but this was rejected and for the moment the company's plans for styrene production have been dropped.

# RUBBER ROUND-UP

**A panel of experts airs its views on what should and should not be done about the rubber situation.**

THE national rubber situation came in for an airing by experts last month when the Chemical Engineers Club of Washington (D.C.) presented a symposium on the subject by six top-ranking members of government and the rubber industry.

Net conclusion reached by most of the audience after some two hours of listening was that the problem of what to do with the synthetic plants is a knotty one. Not limited to the ordinary troubles of orienting a war-born industry into a peacetime economy, it is complicated by such divers tuggings and pullings as national defense requirements, the public pocketbook, the international aid program, and the domestic rubber industry. The final decision, which will probably be made by Congress this spring, appears, the experts agreed, most likely to be based on a delicately adjusted balancing act.

Their other views, opinions and recommendations:

*Admiral C. E. Braine, chairman, Army-Navy Munitions Board Rubber Committee—*

- As long as natural rubber is required for blending with synthetic in tires, this country should, as it is now doing, stockpile natural rubber to the extent required for national security.

*Courtesy R. D. Sheeline*

**RUBBER EXPERTS*: The competitor of natural rubber will probably be an entirely new product.**

- A self-sustaining rubber industry is required for national defense, and it is possible to build such an industry which will not be a drain on the taxpayer.
- A domestic source of natural rubber should be developed.

*William Phillips, International Resources Division, Department of State—*

- Government should limit its operation of the synthetic plants solely to what is needed for national security. Anything beyond this will be interpreted by other nations as an attempt to depress the price of natural rubber.
- Present world capacity to produce rubber is about double world consumption.
- Further work should be undertaken to increase the uses of rubber.

*J. P. Coe, vice-president, United States Rubber Co.—*

- Although 430 variations of GR-S have been manufactured and 50 are now in production, research is still needed on other types and other raw materials.
- Low temperature polymerization (0° to 40°F.) of butadiene and styrene gives promise of a substantially improved synthetic.

*G. B. Hadlock, Office of Rubber Reserve, Reconstruction Finance Corp.—*

- Synthetic has had a definite stabilizing effect on the postwar price of natural rubber, and rubber companies are consequently now able to operate on a 30-day inventory.

*R. P. Dinsmore, vice-president, Goodyear Tire and Rubber Co.—*

- The real competitor of natural rubber will probably be an entirely new product.
- If natural rubber sold for twelve cents a pound, it is unlikely that synthetic rubber would be able to compete.
- At present synthetic would have to have a price advantage of 2 to 4 cents per pound to compete with natural rubber in a free market.

*Representative Fred Crawford of Michigan, vice-chairman, Sub-Committee No. 3 on Rubber, Armed Forces Committee—*

- Minimum capacity for production of synthetic rubber consistent with security is 600,000 tons of GR-S and 75,000 tons of butyl annually.
- One alcohol butadiene plant should be kept in operation for educational purposes.
- All governmental rubber activities should be combined into one agency.

* G. B. Hadlock, Office of Rubber Reserve; Admiral C. E. Braine, Army-Navy Munitions Board Rubber Committee; John T. Cox, Office of Rubber Reserve; John W. Livingston, consulting chemical engineer; R. P. Dinsmore, Goodyear Tire and Rubber Co.

# NEW PROCESS SHORTS

The U. S. Department of Agriculture's Bureau of Agricultural and Industrial Chemistry delves into a myriad fields, and its 1947 report lists a few of its recent developments.

Among the more significant:

(1). A process to render cottons resistant to water penetration.

(2). A differential dyeing test for detecting immature cotton fibres in admixture with mature fibers.

(3). Development of a new industrial applications for soybean protein as an adhesive.

(4). A continuous process for making casein textile fibers and brush bristles.

(5). Recovery of aconitic acid salts from sugarcane molasses—without reducing its sugar content.

(6). Fundamental research findings on the chemical action of herbicides.

(7). Investigation of the submicroscopic structure of hides and leathers.

# VALVING CC'S

**Drawing small volumes from a high pressure system posed a problem and brought forth a new valve.**

WHAT turned out to be something of an engineering poser was encountered in the design of a recently-completed plant in South Africa for the extraction of vitamins from fish oils.

The process called for a valve that would control the withdrawal of a few cubic centimeters per minute of product from a vessel maintained at high pressure. To do the job, E. T. Dahl, president of the Hammel-Dahl Co., Providence, R. I., tried milling some splines into the elongated plug of a diaphragm control valve. The idea worked, and the Microflo valve was born. The valve is now being made so that it will handle pressure drops up to 15,000 pounds per square inch and flow rates down to four cc's per minute in the full open position.

Outside of vitamin production, the valve is being used successfully for the injection of small quantities of fluid into other materials, such as the blending of perfume with soap and tetraethyl lead with gasoline. It has also been used to control fuel flow in rockets and jet engines and the addition of hydrogen in hydrogenation reactions.

### How It Works

Similar in construction to an ordinary diaphragm control vale, the Microflo valve can be built to operate either manually or automatically. Precision control of both flow and pressure is achieved by the four tapered splines which are milled into the plug and by the extremely small clearance between the plug and the seat (0.00003 inch). To prevent galling as a result of this small clearance it was necessary to form both the plug and the seat of solid Stellite.

The splined plug is shown at the top of the accompanying illustration and the 5/8-inch seat at the bottom. The plug is 1/4 inch outside diameter, 1 5/8 inches long and is attached to the diaphragm in the usual manner. The liquid flow passes between the splines, and movement of the plug up and down through the maximum distance allows flow control over a 50:1 range. Fifteen different spline sizes are available, which allow flows in the full open position ranging from four cc's per minute up to 2400 cc's per minute.

SPLINED PLUG: It solved a stickler.

# MODEL BEHAVIOR

**Catalysis, much used but little understood, is largely a matter of molecular geometry.**

TIME WAS when it was enough to know that ethylene is $CH_2$:$CH_2$, ethane $CH_3$-$CH_3$, and all one needs to convert the former into the latter is hydrogen and a nickel catalyst.

Those days are gone forever. Now physical chemists construct molecular models, measure the distances between various component atoms, and know to the calorie how much energy is involved in the transition from one molecular form to the other.

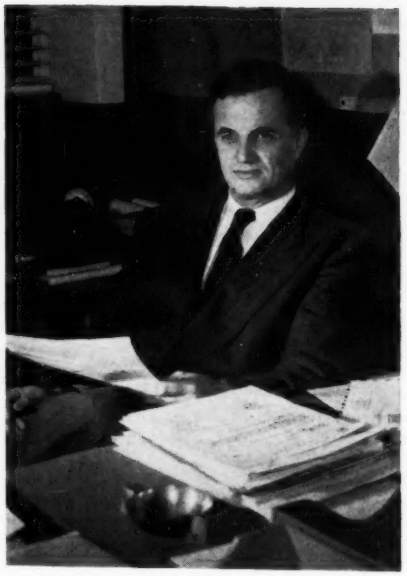
### So What?

To all this the practical chemist, who can turn a fast dollar by cooking up a batch of hair tonic, might reasonably ask, "What's in it for me?"

Truth is, these fundamental investigations into the properties of matter are making themselves felt in chemical engineering technology, opening up new process possibilities, saving expensive man-hours of laborious cut-and-try research.

Hydrogenation of ethylene is a case in point. About ten years ago it occurred to Otto A. Beeck, then head of the Physics Department (now Associate Director of Research) at Shell Development Co., that the rate of that reaction might depend in some way or another on the crystal structure of the catalyst surface; it is hardly necessary to point out that rate of hydrogenation is a dollars-and-cents proposition in the petroleum industry. Ethylene was chosen for study because of its simplicity; besides, a great deal of quantitative data on its properties was already available.

The problem was one to try the patience of a most brilliant and gifted saint. Just a few years ago an expert in the field said, "Superhuman intelligence could perhaps deduce truth from the available imperfect experiments, and practicing kineticists might draw correct conclusions from perfect data. Since neither combination will exist in the foreseeable future, it would seem that practical catalysis must continue to limp along with little help from limping theory."



OTTO BEECK: A crutch for limping catalysis.

### Arrhenius Started It

The trouble is, there are too many steps, each of which is difficult to assess. In the simple example chosen, five separate rates are involved: (1) diffusion of the ethylene and hydrogen to the catalytic surface; (2) adsorption; (3) hydrogenation; (4) desorption; and (5) diffusion of ethane from the surface.

Beeck's attack on the problem started, as all rate studies have started, back in 1889, when Arrhenius laid down an equation for reaction rates which implied that a proportionally few "activated" molecules were responsible for the reaction's taking place. The equation involved the temperature, the "energy of activation," and a constant, C.

Later refinements of his fundamental equation have brought out the fact that a portion of that C is not dependent upon the temperature and must depend on the actual geometry of the participating molecules.

### Molecular Geometry

So Beeck looked into the geometry of the molecules. Best catalysts are pure metals of Group VIII in the periodic system—the nickel, palladium, and platinum series. These had been prepared in the past by hydrogen reduction of the metal oxides, but such catalysts were not reproducible. Beeck prepared them instead by evaporation from pure and carefully degassed metal wires onto glass. The porous metal films thus formed proved to

be of two types: (1) Those evaporated in a high vacuum were—as revealed by electron diffraction measurements—randomly oriented aggregates of minute crystals. (2) Those evaporated in an argon atmosphere were completely oriented. The latter type was five times as catalytically active as the former.

### Rhodium is the Payoff

The crystal lattice of each metal has characteristic dimensions, and it was in the prediction of the most effective metal that the Sherlock Holmesian emphasis on observation and deduction really paid off. A model of the ethane molecule reveals that the distance between the hydrogen atoms in opposite methyl groups is approximately 3.75 Angström units (A.)—just the same as the lattice distance in a rhodium crystal. Beeck predicted that rhodium would be the best catalyst—and (see graph) it was! Looked at very simply, the rhodium crystal holds two hydrogen atoms 3.75 A. apart—the most convenient distance for the ethylene molecule to grab them both simultaneously and become ethane.

### A Clearer Insight

Further analysis of the data shed a great deal of light on the reaction mechanism itself, which may well prove to be of technological value. Of these studies Beeck says that "although we are far from a complete theoretical understanding of catalysis, . . . we nevertheless have a clearer insight into its mechanism. Ten years ago, chemical process engineers who were well aware of the importance of chemical equilibrium in their calculations paid little attention to rate processes. Today the chemical engineer has become 'rate conscious,' which means that we shall have on hand in the near future a more complete and precise evaluation of chemical reactions in the kinetic sense."

The art of catalysis may eventually yield to the science of catalysis.

# SYNTHETIC FUELS

**Major industry status may not be far off as Krug calls for full scale plants and reports progress of Mines Bureau program.**

A STRONG plea for earliest possible construction of initial commercial plants for the production of oil and gasoline from coal and oil shales was made by Secretary of the Interior J. A. Krug late last month in his annual report to Congress on progress of the synthetic liquid fuels research and development program of the Bureau of Mines. Both the acute world shortage of petroleum, which appears likely to extend over several years at least, and the vulnerability of this nation's defenses in case imports of foreign oil were suddenly cut off, appeared to be behind the urgency of the Secretary's message. He added that during the coming year, with the assistance of industrial leaders interested in liquid fuels, he would make specific recommendations for the erection of the necessary plants and the founding of a synthetic fuel industry.

### Synthetic Rubber Times Ten

Preliminary estimates, according to Mr. Krug, indicate that production of 2,000,000 barrels of synthetic oil a day—which is less than 40 per cent of our current daily consumption—would require the use of 16,000,000 tons of steel and an expenditure of about $9,000,000,000. Such an operation would be ten times the size of the synthetic rubber program completed during the last war. The Secretary recommended that a program to accomplish this be set up now to extend over a period of five to ten years.

Reviewing 1947 research and development progress of the Bureau of Mines in its program on synthetic fuels, Mr. Krug reported substantial strides toward the No. 1 objective—establishment of a pattern of scientific, engineering, and economic "know how" on the subject. Following are some of the highlights of his report:

### Oil-Shale Demonstration

Retorts of the Bureau's first oil-shale demonstration plant, at Rifle, Colo., were placed in operation in May. Since then the plant has been producing about 50 barrels a day of crude shale oil. Pending completion of a refinery, now under construction, this crude is being used in laboratory engine tests and combustion and refining studies.

The present estimated cost of producing crude shale oil on a large scale is, roughly, $2 to $2.50 per barrel. The product would not compare favorably in quality with oil produced from natural petroleum now selling at those prices.

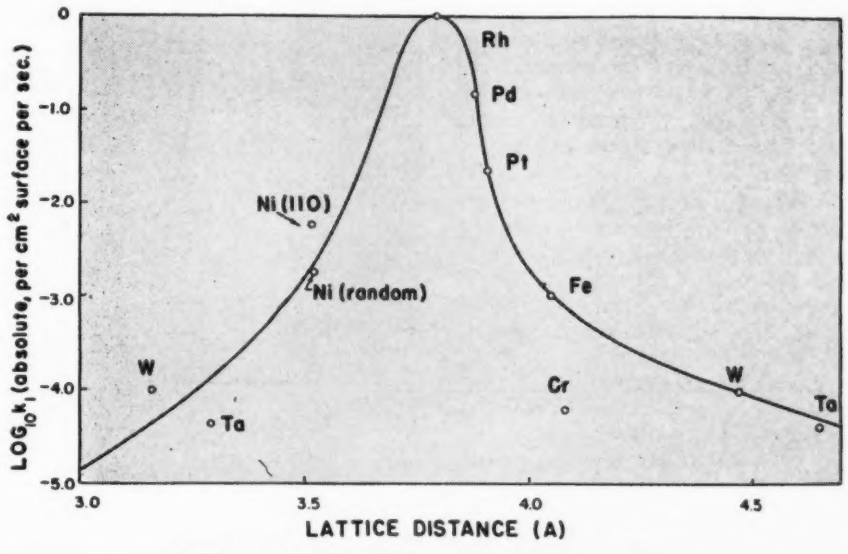
Two shale mines have been opened by the Bureau, one a small operation for supplying shale to the retorting plant, and the other a larger development for the purpose of studying mining methods and costs on a commercial scale. This work has demonstrated that shale can be mined mechanically for as little as 70 cents a ton, and mining engineers believe this can be reduced to 50 cents.

### Coal-to-Oil Work

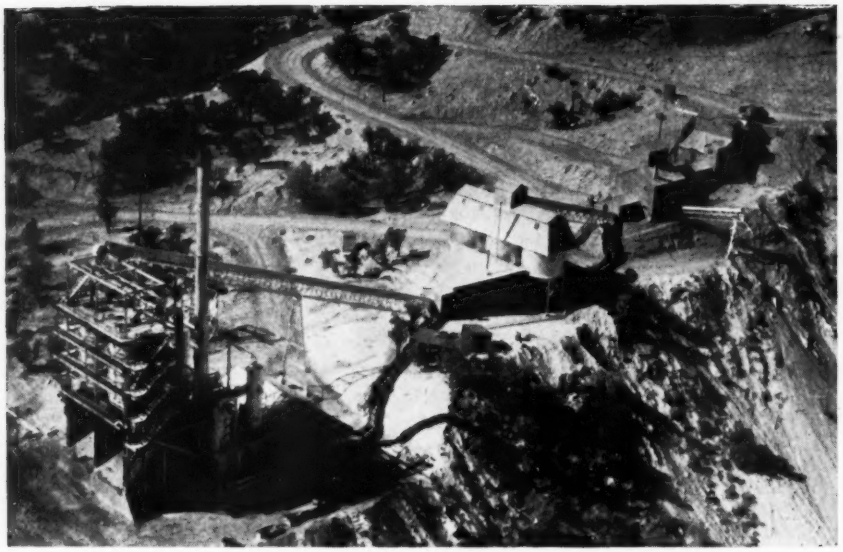
A demonstration plant to produce about 200 barrels of gasoline a day by the hydrogenation of coal is under construction on the site of a Government-owned wartime synthetic ammonia plant at Louisiana, Mo. To be completed this year, the plant will use from 100 to 200 tons of coal or lignite daily and will operate in a pressure range between 4,000 and 10,000 pounds per square inch.

Under present conditions it is estimated that a high-grade motor gasoline or aviation gasoline can be produced commercially by hydrogenation of coal for about 14 cents a gallon, which is some 5 to 7 cents more per gallon than the current cost of gasoline from petroleum. This figure allows for plant amortization but otherwise includes only production costs. On the other hand, no credit has been taken for byproducts which may reduce the cost of the product in some plants by 3 to 5 cents a gallon.

If funds are available, construction will begin next summer on a gas synthesis (Fischer-Tropsch) demonstration plant to produce motor gasoline and Diesel fuel from coal. This plant also will be erected at Louisiana, Mo., and will make about 50 to 80 barrels of oil daily. It will have coal-gasification units of a new design and will incorporate a newly-developed converter unit which can be built to produce 500 or more barrels daily as compared with a capacity of 18 barrels a day for the German converters. It is estimated that a good grade of motor gasoline and an excellent Diesel fuel can be produced through this process at costs which approximate those of the coal hydrogenation process.




RATE vs. LATTICE: Rhodium pleased the prognosticators.



**SHALE-OIL PLANT: At Rifle, Colo., 50 barrels a day.**

The report also disclosed that the Northern Regional Research Laboratory of the Department of Agriculture at Peoria, Illinois, has demonstrated that the pentosan fraction of corn cobs can be satisfactorily hydrolyzed to pentose sugars and that the sugars can be fermented to liquid fuels, presumably alcohol. The Laboratory claims that it has worked out an efficient process for the latter step. The Department of Agriculture is also working on other waste products.

# LIQUID KILLER

**Output of 2,4-D is expanding, will be marketed largely as a liquid.**

WHEN it was first marketed, 2,4-D was sold largely as a powder—usually the sodium salt. During the coming season most 2,4-D will be sold in the liquid form, either as the ethanolamine salt or as the isopropyl ester. In point of 2,4-D poundage to be marketed, the amine salt will probably rank first, the ester second, and the powder third. The reasons for this change in the market picture are not hard to find.

When first introduced for large scale application the powder was dusted, usually by airplane, on the fields of narrow-leaved plants. However, sugar cane and rice fields have a bad habit of being adjacent to fields of broad-leaved cotton. Thus an appreciable amount of the dust intended for the sugar cane or rice drifted over and settled on the cotton. The drifting spelled death for the cotton; and some cotton farmers in Louisiana threatened to prevent ". . . another pound of that —— stuff from crossing the state line."

### A Liquid Is Called For

Spraying a 2,4-D solution was one answer. But the sodium salt of 2,4-D is a powder and is thus attended by all the difficulties for the average user in making up a solution of a given concentration. In addition the sodium salt has a limited solubility. Thus came about the inception of the amine salt with its much greater solubility and consequent greater versatility when used in solution. The ester can also be readily mixed with water.

Possibly these reasons alone would have been sufficient to overcome the problem presented by the increased cost of the two new liquid forms. However, many tests have given an indication that the ester and the amine salt, in that order, are more potent than the sodium salt. It is generally considered that more tests are necessary to establish this point conclusively. Also, in special cases it has been found that some weeds are resistant to one form and not to the other.

### Debit Entries

All of these blessings have not been procured without some entries on the debit side of the ledger. In addition to its higher price, the ester, which is usually considered to be the most potent, is the most hazardous to use; i.e., greater care must be taken to prevent an overdose.

One manufacturer has utilized time on a national radio hookup to extol the virtues of 2,4-D for ridding corn of weeds under practically any condition. Another equally large producer has expressed a fear of indiscriminate use, although the company acknowledges that proper application will do an excellent job. Its feeling is that not enough information is available to enable the proper method of application to be established with certainty. Only time will settle this dispute.

### Production Expanding

The success of the use of 2,4-D can be ascertained to a certain extent by the fact that production is expanding. One producer notes that in spite of expanded capacity, 2,4-D may very well be in short supply this next season. It has been most successful in controlling the growth of broad-leaf weeds in fields of rice, sugar cane, small grains and corn at a total cost of application approximating $3 an acre.

# DROP BY DROP

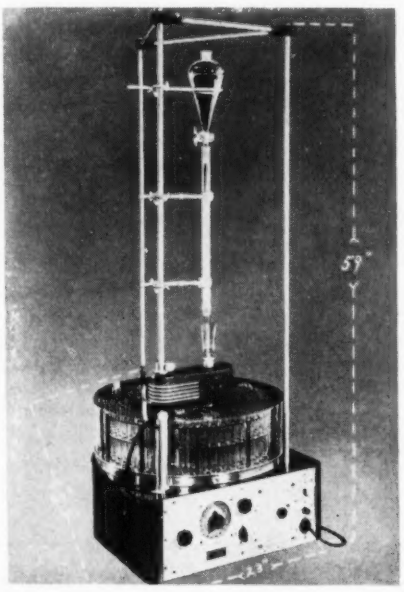
**A new instrument, originally designed for medical research, takes over a tedious task in industrial laboratories.**

TAKING HOLD of a new idea, grappling with it, and exploiting its commercial potentialities is nothing new for Edwin C. Weiskopf and his Technicon Co. Back in 1939, for instance, when Mr. Weiskopf decided that the laboratory supply business (in which he had been engaged for thirty years) was no longer attractive, he designed a novel apparatus to prepare animal tissue for examination. Today, his Auto-Technicon is as standard equipment as a microscope in every major hospital and medical center.

And last month, Technicon brought out another unique product—an automatic fraction collector for chromatographic analyses—which, although originally designed with an eye to medical needs, is attracting the attention of chemical, food, petroleum, and paper concerns. (Actually, industry ranks as the number one market, for of the 15 collectors sold to date, three have gone to hospitals, a dozen to industrial laboratories.)

### Divides by Two Hundred

Chromatography has been defined as "a method of chemical analysis founded on differential adsorption in a countercurrent process." Strangely, the technique was discovered not by a chemist, but by a Polish botanist, Tswett, over thirty years ago. It is only within the past decade that chemists have recognized its outstanding value and made use of it, both in analysis and in the separation and puri-



**TECHNICON: Even on holidays, fractions galore.**

fication of raw materials, intermediates, and synthetic products.

In a chromatographic separation, the mixture dissolved in a suitable, non-adsorbed solvent, is dripped slowly into the top of a column containing silica gel, alumina, clay—or even sugar. The adsorbent—which must be neither too strong nor too weak—is selected to suit the "adsorbee."

The desired materials are adsorbed at the top of the column. Then fresh solvent is dripped in, and the adsorbed materials are washed down the column. The most weakly adsorbed component washes down first, the most strongly adsorbed last. The intermediate ones, of course, march along in the middle of the procession.

Briefly, the fraction collector is a machine which will, completely automatically, collect a predetermined and rigidly controlled volume of fluid in each of 200 test tubes, then automatically shut itself off. The instrument (see cut) is activated by means of falling drops interrupting a light beam which, registered on a photoelectric cell, sends impulses to an electronic counter. This counter is adjustable for any number of drops from one to four hundred.

After the selected number of drops are collected in a test tube, the tube carriage advances and the same number of drops are tapped into a second tube. This process repeats itself through any number of tubes up to the 200 maximum. The tubes, themselves, are arranged in four concentric rows of fifty each.

When the collection process is complete, or the prescribed number of tubes has been filled, the carriage swings toward the center of the machine and a glass scoop flips into position to carry off the excess fluid.

**No Featherbedder**

The main asset of machine-collection is, of course, the elimination of human errors, and, naturally, the saving of manpower. (In one installation a unit is replacing 14 technicians, freeing them for more useful and less tedious work.) Furthermore, the machine is strictly a non-union worker, plugs away 24 hours a day—even holidays! In another respect, too, automatic fraction collecting holds an advantage, for it permits greater resolution, renders practicable the taking of numerous smaller fractions rather than fewer large ones. This gives more information from a particular fractionation.

At the moment, Technicon, which completed engineering work on the collector in eight months, has made only a few units. Nevertheless, a motley collection of industries is already on the customer list—chemical, paper, distilling, petroleum, pharmaceutical, and even explosive makers. And, in the near future, the company expects to pay even more attention to the market it didn't realize existed.

# SEVERAL NATIONS TRIM CHEMICAL TARIFFS

BETWEEN January 1 and June 30 of this year, all 23 nations participating in the Geneva tariff agreements will put the provisions of those agreements into effect. The U. S., U. K., France, Canada, Benelux (Belgium-Netherlands-Luxembourg) and Australia signed up the first of the year, and the other nations are standing by only until they can legally comply in accordance with their own constitutions and statutes. The roster includes Brazil, Burma, Ceylon, China, Cuba, Czechoslovakia, India, Syria-Lebanon, New Zealand, Norway, Pakistan, Southern Rhodesia, and the Union of South Africa.

Here are the chief concessions on chemicals and chemical products, as provided by the new agreements.

| *Concessions by* | *On* | *New Duty* | *Former Duty* |
|---|---|---|---|
| United States | Hydroxycitronellal | 15% ad valorem | 22½% ad valorem |
| | Other aromatics except linalyl acetate | 30% a. v. | 45% a. v. |
| | Mixtures of perfume materials | 30¢/lb. + 20% a. v. | 40¢/lb. + 30% a. v. |
| | Perfumery containing alcohol | do. | 40¢/lb. + 37½% a.v. |
| | Perfumery not containing alcohol | 20% a. v. | 37½% a. v. |
| | Toilet preparations containing alcohol | 30¢/lb. + 20% a. v. | 40¢/lb. + 37½% a.v. |
| | Toilet preps. not containing alcohol ("Toilet preparations" do not include liquid perfumes, toilet waters, and bath salts) | 20% a. v. | 37½% a. v. |
| | Glycerin, Crude | 0.4¢/lb. | 0.8¢/lb. |
| | Refined | 1¢/lb. | 1-7/15¢/lb. |
| | Caffeine | 60¢/lb. | 90¢/lb. |
| | Rubbers, Synthetic | 10% a. v. | 20% a. v. |
| | Caffeine citrate | 50¢/lb. | 75¢/lb. |
| | Caffeine compounds, Other | 17% a. v. | 25% a. v. |
| | Theobromine | 40¢/lb. | 65¢/lb. |
| | Menthol, Natural and synthetic | 40¢/lb. | 50¢/lb. |
| | Ammonia, Anhydrous | 1¼¢/lb. | 2½¢/lb. |
| | Antimony oxide | 1¢/lb. | 2¢/lb. |
| | Barytes | $3.50/ton | $4.00/ton |
| | Bauxite | 50¢/ton | |
| | Zinc ore | ¾¢/lb. of Zn | |
| United Kingdom | Sulfur | free | |
| | Rosin | do. | |
| | Carbon black | 10% a. v. | |
| | Paraffin wax | do. | |
| | Petroleum jelly | do. | |
| France | Borax, Refined | reduced 68% | |
| | Benzol, toluol | reduced 32% | |
| | Organic chemicals, Various | reduced 20-40% | |
| | Borax, Refined anhydrous | free | |
| | Sulfur, Raw | do. | |
| | Borax, Crude | do. | |
| | Carbon black | do. | |
| | Sodium nitrate | do. | free; with quota |
| Australia | Carbon black | free | |
| | Paraffin oil, Non-medicinal | substantial reduction | |
| | Turpentine substitutes | small reductions | |
| India | Paints, Certain | reduced | |
| | Menthol | 24% a. v. | 36% a. v. |
| New Zealand | Paints, Ready-mixed | margin of preference reduced 33⅓% | |
| Ceylon | Chemicals, paints, colors and enamels, Certain | reduced 20% | |
| Brazil | Dyes, Coal-tar | reduced 30% | |
| | Turpentine | reduced 30% | |
| Chile | Mixtures of chemicals for pharmaceutical products | reduced 50% | |
| | Cresylic acids containing phosphorus sulfide (for mineral flotation) | reduced 33⅓% | |
| Cuba | Turpentine, Oil of | reduced 50% | |
| | Colors, Artificial (powder or lump) | reduced 33% | |
| Czechoslovakia | Rosin | free | |
| | Colophony | do. | |
| | Phosphate rock | do. | |
| | Borax, Crude | do. | |
| | Turpentine | do. | |
| | Sulfur | do. | |
| | Pastes, Cleaning | moderate reduction | |
| | Sodium nitrate, Synthetic | free; with quota | |
| Benelux | Sulfur, Crude | free | |
| | Silicon carbide | do. | |
| | Boron carbide | do. | |
| | Lampblack | do. | |
| | Fertilizers, Certain | do. | |
| | Turpentine | do. | 10% a. v. |
| Lebanon | Insecticides, disinfectants and similar preparations | free | |
| Norway | Sulfur | do. | |
| | Bone black | do. | |
| | Graphite | do. | |
| | Stearic acid | do. | |
| | Fatty acids, Certain other | do. | |
| | Insecticides | do. | |
| | Weed killers | do. | |
| | Turpentine | reduced 43% | |
| China | Insecticides | moderate reductions granted | |
| | Disinfectants | do. | |

# MILDEWPROOFING COMPOUNDS

## New Chemicals, New Knowledge Can Curb Fungus Ravages

by S. S. BLOCK,
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**MILDEW IS NOT MERELY THE MOLD THAT forms on stale bread, nor is it a nuisance encountered only in the tropics. Rather, such fungus growths are rampant in the U. S., cost makers of paints, textiles, cosmetics, etc., millions of dollars annually. To meet multifarious industrial needs, and those of specialty compounders, chemical manufacturers have developed an impressive number of new products and application techniques.**

**As well as winning industry's acceptance, mildewcides are also entering retail fields.**

ALTHOUGH the mildew problem has always been a plague to mankind, its devastating effects were dramatically illustrated in the war against Japan. Combat groups, making beachheads in the hot, humid Pacific islands suddenly discovered their radio equipment would not function because mildew had grown on vital insulation so that it no longer insulated. Binoculars and camera lenses were found spotted and etched where mold had flourished. Tenting and other service fabrics fell apart as a result of the rotting action of cellulose-decomposing fungi.

### MULTIMILLION DOLLAR PROBLEM

Apart from the tremendous economic importance of the parasitic fungi that attack crops, animals, and man himelf, the saprophytic fungi that attack non-living matter cause economic losses in the United States that run ito many millions of dollars a year. The accompanying map, prepared by Givaudan-Delawanna, Inc., illustrates how little of the country is relatively safe from the deleterious actions of fungi. The areas most vulnerable are, as shown, the Southeast and South Central U. S., particularly Florida and the States bordering the Gulf of Mexico. The export market for mildew preventives is a potentially large field as has been demonstrated to the author by the large foreign response to his writing on the subject. Wherever the conditions of high humidity and moderate-to-high temperatures prevail, the mildew problem exists.

Mold, mildew, rot, and decay are terms used in referring to fungi depending upon their appearance and the type of damage they do.

Mold and mildew are noted as aerial growths and result in surface spotting whereas rot and decay fungi grow below the surface and often bring about complete deterioration. Mildew appears to the unaided eye as a network of threads, resembling cotton, which are topped with a mass of color, usually black, green, or yellow. The colored material is a powdery dust made up of tiny particles known as spores. These spores are the seeds of the parent plant and are capable of remaining dormant for long periods of time until conditions favor germination.

Fungi are simple plants that lack the ability to synthesize their own food and must utilize organic materials as nutrients. When, in fulfilling this requirement, they attack materials of value, they become a menace of considerable economic significance.

### PHYSICAL CONTROLS

Mold growth may be controlled by denying the mold organism the materials and environmental conditions necessary for carrying on its life functions. For example, cleanliness is a factor in mold control for it helps to deprive molds of the nutrients essential for growth. It is not always a dependable method because molds are able to maintain themselves on minute quantities of organic materials. For instance, handprints overgrown with mildew will often appear on drycleaned garments that are handled in being put away.

Oxygen is an essential for mold growth. Its removal by vacuum packing or displacement with inert gases provides for successful shipping of perishables. Molds are not very critical regarding temperature. Most types can grow between 40° and 140° F although their optimum growth is at approximately 90° F. Sterilization by heat and refrigeration are common means for checking microbial growth. They are, for instance, the most widely practiced techniques used in the preservation of foods.

A practical method for restricting the proliferation of mold is the regulation of available moisture. Abundant moisture is a primary necessity for mold propagation. Moisture removal may be effected in several ways. Salting and sugaring of foodstuffs prevents mold spoilage by increasing the osmotic pressure by the solution within the material, thus reducing the quantity of free water present. On dry materials, a regulation of the moisture in the atmosphere may produce the desired results. This may involve increasing the water-holding capacity of the air by the use of heat or removing water from the air with dessicants. The moisture-holding capacity of air at 120° F is four and one half times that of the air at 80° F. The available moisture for mold growth, as indicated by the rela-

tive humidity, is thus lowered by heating. Lowering the relative humidity of the air in clothes closets by simply burning an electric light bulb in the closet is a convenient means of protection against mold damage in the home.

The lowest relative humidity permitting mold growth varies depending upon the mold type and its substrate. It may safely be stated, however, that no mold problem exists where the relative humidity of air at the surface of the substrate is under 75 per cent. The restriction—"at the surface of the substrate"—is necessary, for poor air circulation may permit mildew conditions even though the air itself has a low relative humidity. This is particularly true where considerable fluctuations in temperature may bring about precipitation of moisture from the air. The rate of mold growth increases markedly as the air approaches 100 per cent relative humidity. Some non-hygroscopic materials will support mold only when the atmosphere exceeds 95 per cent relative humidity.

## DESICCANTS USED

The use of desiccants to remove air moisture has recently come into wide use. Calcium chloride and silica gel are employed to dry out basements, storage rooms, and closets. Both materials may be employed in industrial units or in simple static units for the home. Calcium chloride is cheaper than silica gel and has greater capacity for moisture. It dissolves in the absorbed water, however, making it necessary to remove the resultant solution. The silica gel granules adsorb moisture without becoming wet and may be regenerated by heating at 300° F when exhausted. Silica gel will take up one third of its weight of water before requiring regeneration. Cobalt chloride treated granules, known as "Tell Tale" silica gel, indicate in a convenient manner when it is time to regenerate. (The granules are blue when the silica gel is active and pink when it is exhausted.) Industrial units for dehumidifying with silica gel provide for regeneration and air circulation. The flat can, home-type unit holds 5 pounds of silica gel and is well perforated to facilitate contact of the air and the silica gel.

Calcium chloride is dispensed as the commercial flake, $CaCl_2.2H_2O$, containing approximately 80 per cent $CaCl_2$, or as specially pressed cylindrical forms made from the flake. All of the calcium chloride containers consist of a holder for the solid desiccant and a receiver to catch the liquid drippings. The most common and least complex of the containers utilizes a paint can, a support for the cake of calcium chloride, and a perforated disk to permit the solution to drip into the lower half of the can. The unit is self-contained, disposable, and retails for less than a dollar. More efficient units have various shapes that make possible better contact of the deiccant with moisture-laden air.

In industrial units that provide for circulation of air through the saturated solution the desiccant will pick up twice its weight of water and provide mildew-free conditions. In the static, drip containers the desiccant picks up one half to one times its weight of water and goes into solution. Although the saturated solution is capable of further dilution, the rate is so slow without air circulation that the solution is discarded. When all the solid calcium chloride has disappeared, it is a reminder to recharge or replace the unit.

## CHEMICAL COMBATANTS

Whereas physical methods for mold control are satisfactory in many instances, in the majority of applications chemical methods must be resorted to. Fungicidal chemicals act as poisons to molds by interfering with the normal metabolism of the cells in ways that are as yet not well understood. The specific application of the fungicide determines the chemicals that can be employed. For tents and awnings, the chemicals should be resistant to leaching and sunlight. For articles of personal use the qualities sought are lack of color, odor, and irritation to the skin. In foodstuffs, toxicity is the factor of chief importance. Most of the principal industrial fungicides fall into the following derivatives, and organics of sulfur and nitrogen.

Of the metallics, the compounds of copper and mercury are the most important. Copper is highly effective against the cellulose-rotting fungi, whereas mercury is extremely potent against the surface mildews that are resistant to copper. The copper soaps, such as copper naphthenate, copper resinate, copper oleate, and copper tallate are greenish-blue, waxy solids that are readily applied in petroleum solvents. Copper ammonium hydoxide and copper ammonium fluoride are water soluble when applied but are rendered insoluble by the loss of ammonia. Copper pentachlorophenate and copper quinolinolate combine the fungicidal activity of copper with that of a fungicidal negative radical. These materials are applied by a two-bath process.

## MERCURIALS

The phenylmercurics render important service in a great many industries. They are used in tanning, in paints, in paper mills, in sap stain prevention of lumber, and wood impregnation.

Similar to the phenylmercurics are the newly-developed pyridylmercurics — the stearate, chloride, and acetate. These compounds are suggested for use in fabrics, rubber, paper, cork, lacquer, and wax fungus-proofing. The high water solubility of pyridylmercuric acetate is unique in this group and the phenylmercurics. Under the trade name "Pyridose" (Mallinckrodt) it is sold as a slime control agent for paper mills.

Although zinc compounds are not as powerful fungicidally as some of the other heavy metal chemicals, they have the advantages of being colorless and less poisonous. Zinc naphthenate is used on fabrics, such as awnings, where it is about half as effective as copper as a fungicide. Zinc oxide is used as a toxic pigment in paints, and zinc chloride is a well-known wood preservative. The dithiocarbonates of zinc have been used as fabric protectants but their greatest sales are in the agricultural field. The compounds of lead, cadmium, silver and thallium are strong fungicides but are of less industrial importance than copper, mercury, and zinc derivatives.

## IMPORTANT PHENOLICS

Of the purely organic fungicides the phenolics are of greatest commercial consequence. They include the halogenated, phenylated, benzylated, and nitrated derivatives of phenol, cresol and xylenol.

*Courtesy Givaudan-Delawanna, Inc.*

**Scientist studies fungus under magnifying glass to determine type, stage of growth.**

as well as many others that might be classified as phenolics. Phenol itself is not a very powerful fungicide but halogenation of phenol steps up its toxicity to molds. The "Dowicides" are a series of halogenated and phenylated phenol derivatives and their water-soluble sodium salts. Among these, trichloro, tetrachloro and pentachlorophenol are highly effective on a large number of mold types. They have the typical phenol odor and must be handled carefully to prevent skin irritation.

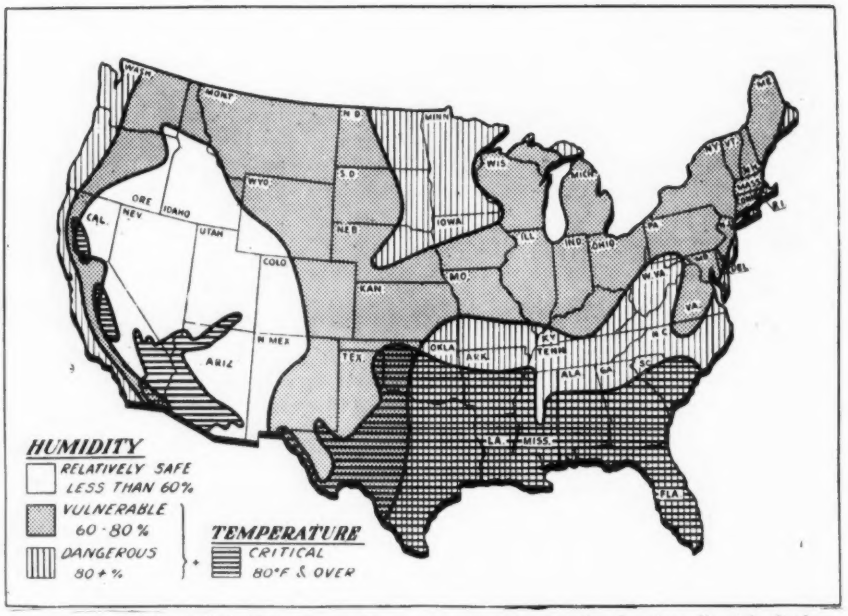
The trichlorophenol finds use in the preservation of pastes, glues, and coating solutions. Tetrachlorophenol and its sodium salt render service in protecting wood pulp, building board, and water paints from mold attack. Pentachlorophenol has come into prominent use as a wood preservative recently as a result of the shortage of creosote because the penta is among the cheapest—currently about twenty cents a pound—and most potent anti-mold chemicals. It is a large volume chemical and has many specialized uses as an industrial fungicide. Some of these uses are in mold-proofing egg crate filters, indoor and water-type paints, starch-coated paper, electric cable braid, prevention of sap stain on finished lumber, and slime control in paper mills.

Orthophenyl phenol is an interesting member of this family because it is much less of a toxic hazard and skin irritant than its chlorinated relatives. In addition, its mild odor along with the above properties, make it suitable as the active ingredient in household mildewcides. A proprietary having national distribution, "Mil-Du-Rid" (Interchemical Corporation), utilizes two per cent of orthophenyl phenol in an aqueous emulsion.

## CHLORINATED PHENOLS

In general, the chlorinated phenols have not been satisfactory for rot protection on fabrics exposed to weathering. They are too readily leached by rain and are susceptible to photochemical breakdown yielding hydrochloric acid which weakens the cloth fibres. An exception is a newcomer, dihydroxy-dichloro-diphenylmethane, known as "Fungicide G-4" (Givaudan-Delawanna). This material withstands the rigorous soil burial test unusually well and has the additional desirable property of being relatively non-irritating to the skin. Tetrabromocresol, "Fungicide 242" (Merck), is another halogenated phenolic which has stood up under exposure to weathering.

Salicylanilide, or "Shirlan" (Du Pont), is an excellent product. It is a white powder with practically no odor, low toxicity and effective fungicidal properties. It has been used for the past twenty years by the British for protecting woolens during shipment. "Shirlan" is available as a concentrated powder for application from organic solvents or ammoniacal solution, as an aqueous emulsion for use with emulsion water repellents, and as a dispersible powder for application in water.




**Contrary to popular belief, high temperatures are not necessary for fungi to flourish. Rather, humidity conditions are the more important factor. Map highlights vulnerable U. S. areas.**

## QUATERNARIES

Because of their highly bactericidal properties and low toxicity it was hoped that the quaternary nitrogen compounds would be useful for combating mildew. Up to the present time, however, only one quaternary has appeared that is an effective industrial fungicide. This is trimethyl-cetyl ammonium pentachlorophenate, "Hyamine 3258" (Rohm and Haas), which combines the properties of a quaternary with those of pentachlorophenol. Because of its low toxicity and mild odor it is being used by several producers in a household mildewcide. Being cation active it is substantive to cellulose and is employed for treating thread. It cannot be used in the presence of soaps and other anionic materials.

A promising new field for manufacturers of specialty and sanitary products that waits to be exploited is the production of mildewcides for institutions and the home. Although there is a large potential market in the area of this writer's residence, there is only one product retailed locally. Drug, hardware, grocery and department stores offer a wide outlet for distributing this type of product.

The Nuodex Co. has discussed many potential applications for a household mildewcide in the promotion literature on its household microbicide, referred to as "Nuodex 87." Some of the suggested uses are: Protection of clothes in closets and storage; mildewproofing shoes and leather goods; elimination of musty odor in closets; prevention of mildew in laundry before ironing; anti-mold wash for walls in food plants, breweries, etc.; additive for use in rug cleaning and dry cleaning to mildew-proof; preparation of walls before painting to retard surface molds.

To satisfy the requirements for a household product, the active ingredient should preferably be odorless, colorless, non-irritating to the skin, not highly poisonous, residual in performance and effective against a wide variety of molds.

## BASIC FORMULAS

A household proprietary that has been in use for three years, "Mil-Du-Rid," has approximately the following composition:

| | |
|---|---|
| Phenylphenol | 2.0 per cent |
| Isopropyl alcohol | 3.5 per cent |
| Soap | 4.0 per cent |
| Mineral oil | 5.0 per cent |
| Water | 85.5 per cent |

A formula with "Hyamine 3258" is being used by several companies supplying a household mildewcide:

| | |
|---|---|
| Hyamine 3258 | 10 per cent |
| Isopropyl alcohol | 10 per cent |
| Triton X-155 | 1 per cent |
| Water | 79 per cent |

For treatment of textiles by the home owner, Givaudan-Delawanna has recommended the following solution. Without the water-repellent ingredient, the formula can be used for general household service. The naphtha solution is preferable to an aqueous solution for treating clothes:

| | |
|---|---|
| Fungicide G-4 | 1 per cent |
| Water Repellent SW-56 (Onyx) | 6 per cent |
| Isopropyl alcohol | 9 per cent |
| Stoddard Solvent | 84 per cent |

In Bulletin No. 12, "Mold and Mildew Control," issued by this Station, a solution of 0.5 per cent salicylanilide in isopropyl alcohol for general household use was recommended. The Nuodex Co. features a product called "Nuodex 87" for this purpose. It is a clear liquid to be distributed by local suppliers as a 5 per cent solution in water. The final product is milky and has a pleasant odor. An ideal product for fabrics would be the counterpart of the "Eulan" moth-proofer

—a colorless dye that would render the fabric mildew-proof, but resistant to removal by washing and dry cleaning.

## COMMERCIAL PROCESSING

Synthetic fibres like Nylon, Saran, and acetate rayons do not support mold growth and are very resistant to the molds' digestive enzymes. Natural protein fibres, silk and wool, are not deteriorated by fungi but may be spotted by surface molds. Cellulose fibres, cotton, hemp, jute, and sisal are highly susceptible to complete decomposition by cellulose-fermenting fungi. Cellulosic materials that are exposed to water and high humidity must be protected from rot organisms or their service life will be materially shortened. Articles requiring protection include ropes and nets, tents, awnings, beach chairs, tarpaulins, fire hose, boat sails, filter cloths, and so on.

To apply the protecting chemical the cloth is run through a solution of the fungicide in a volatile solvent. This is known as the single bath treatment. The two-bath treatment is required when applying a material that is not soluble in ordinary, cheap solvents. After the cloth passes through the bath the excess solution is squeezed out by means of a mangle so that a known weight of solution is taken up. Assuming 50 per cent pick-up, one gallon of solution will treat approximately 30 yards of an 8 ounce cotton duck cloth. For ropes and nets, soaking in the treating solution is necessary. Dipping is the preferable method of treatment to obtain total wetting, but spraying, brushing and sponging are used where dipping is not practical. Water repellents are often added to the treating bath or applied separately. They are important in that they prevent loss of the fungicide by leaching.

In tests at this Station it was observed that copper and silver preservatives gave much superior protection in outdoor weathering tests than do other metal salts and pure organics. The untreated controls lost 70 per cent of their strength the first year outdoors and 95 per cent after two years. With 1 per cent of copper fungicides, the fabric samples lost only 10 per cent of their initial strength the first year and 25 per cent after two years. The anion with copper did not appear to be important except to prevent the loss of copper. Fungus stain on the fabric samples also yielded best to copper and silver treatments. The mercurials were much less effective than copper. The phenolics gave excellent protection the first year when used in conjunction with a water-repellent treatment.

The effect of mold growth in paints is not to destroy the coating but to achieve the same end by rendering it spotted and unsightly. Shaded exterior surfaces which are near trees and shrubbery, or other sources of moisture, are more likely to mildew than sunny southern exposures. The interior paints of poorly ventilated rooms, bathrooms, kitchens, bakeries and textile mills are subject to mildew. Linseed oil vehicles, casein, oil-rich alkyds, melamine-formaldehyde, and nitrocellulose are susceptible to mold proliferation. Urea-formaldehyde, phenol-formaldehyde, cellulose acetate, ethyl cellulose, polystyrene, vinylites, and chlorinated rubber do not support mold growth. Even though some resins do not satisfy the growth requirements for molds they cannot be depended upon to be rid of mold where grease and dirt may collect on the painted surface.

*Courtesy Interchemical Corp.*
**Packaged mildewcides are now being sold to treat bread boxes, awnings, leathers, etc.**

The drying speed and water resistance of oil paints influence their susceptibility to mildew. The addition of tung oil and spar varnishes to linseed oil paints make them more impervious to water and more resistant to mold growth. Zinc oxide pigment serves both as a fungicide and to effect hard drying of the film.

Long experience with toxic ingredients for paints has demonstrated the outstanding effectiveness of mercury compounds in checking mold contamination. Under ordinary conditions bichloride of mercury has been shown to give complete protection from mildew when incorporated in the paint to the extent of 1 part of the toxicant to 500-900 parts of paint. For severe conditions twice as much of the fungicide is employed. The chemical may be mulled into the oil or added in the form of an alcohol solution.

Because of the poisonous properties of mercury and the bad sales psychology of poison warnings on their product label, as well as certain other considerations, paint manufacturers have not chosen to mildew-proof their paints. Instead, specially packaged paint additives containing the fungicide are sold for on-the-job incorporation in the paint. Such a product, "Mildew Stop" (Sears Roebuck), has the following composition:

| | |
|---|---|
| Bichloride of Mercury | 1 per cent |
| Zinc Oxide | 75 per cent |
| Linseed Oil | 24 per cent |

One-half pint of this paste is mixed into a gallon of oil paint to give approximately 0.1 per cent bichloride of mercury in the finished paint.

Organic mercurials such as the phenylmercuric oleate, phenylmercuric naphthenate, and pyridylmercuric stearate are sometimes preferred because they are oil soluble, water insoluble, and less poisonous than mercuric chloride.

For indoor and protein-base paints, the phenolics are used in place of the mercurials. Tetrachlorophenol has been widely used for this purpose. A paint additive sold under the name of "Mildew-X" (Glidden) is made up of 85 per cent tetrachlorophenol and 15 per cent solvent, probably acetone. Four ounces of this material, a liquid, added to a gallon of indoor paint gives a concentration of the phenolic in the paint of approximately 2 per cent.

Before an already mildewed surface is repainted, it is good practice to get rid of the mildew by cleaning and disinfecting the surface. A 0.2 per cent solution of bichloride of mercury serves well as a disinfectant for this purpose.

## PROTECTION OF LEATHER

Leather goods are very susceptible to attack by mildew. Although the leather protein is not utilized by fungi, the oils, greases, tanning materials, and soluble constituents of the leather serve as food for molds. Tests at the National Bureau of Standards have shown that mildew is capable of staining leather, increasing its stiffness, and weakening the grain surface. Vegetable-tanned leather molds much more readily than chrome-tanned leather. Chrome tanning exerts a mold inhibiting influence and also renders the leather more water resistant.

For mildew-proofing leather a number of fungicides have been found that will control the mold and not affect the leather. Among these are paranitrophenol, para-chloro-meta-xylenol, para-chloro-meta-cresol, salicylanilide, and dihydroxy-dichloro-diphenyl methane. The fungicides may be applied with the tanning liquors or the stuffing grease. Finished leather may be sprayed with the fungicide or treated with a wax polish or grease dubbing containing the fungicide.

A formula for a regular army waterproofing dubbing with added fungicides is as follows:

| | |
|---|---|
| Paranitrophenol | 0.8 per cent |
| Para-chloro-meta-xylenol | 0.8 per cent |
| Tetrachlorophenol | 0.8 per cent |
| Beef Tallow | 47.6 per cent |
| Neatsfoot Oil | 40.0 per cent |
| Mineral Wax | 9.0 per cent |
| Aluminum Stearate | 1.0 per cent |

One does not usually consider glass as a material that is affected by mold growth; however, in tropical climates the deterioration of costly optical instruments resulting from mold growth on the lenses is a serious problem. During the war this problem became a hazard to men in combat employing cameras, binoculars, and gun sights that were spotted or obliterated by mold. Under favorable moisture conditions, mold spores inside the instruments, or carried in by tiny mites, germinate and grow over the lens surfaces. Specks of organic matter serve as nutrients for the mold which extends its mycelia over the surface of the lens, making vision with the equipment difficult or impossible. In time, the chemical exudates of the mold actually etch the glass, thus destroying the equipment.

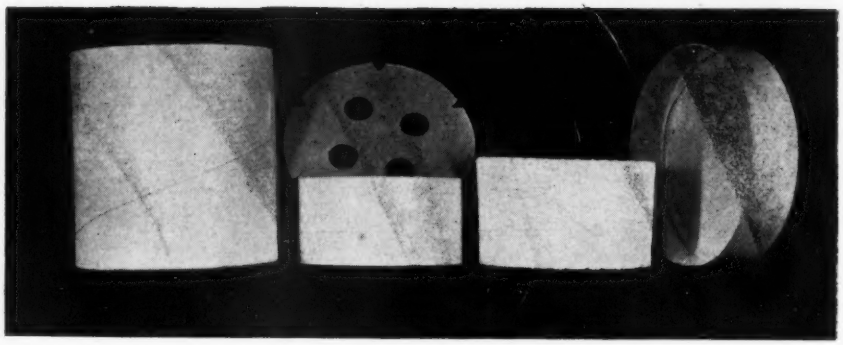
A volatile fungicide, mata-cresyl-acetate, known as "Cresatin" (Sharp and Dohme), was used effectively on optical instruments. The liquid fungicide was mixed with ethyl cellulose and forced into aluminum capsules provided with small openings for slow evaporation of the "Cresatin." These capsules were placed inside the equipment, near the lenses, but outside the path of light. Other volatile materials having fungistatic vapors are ethyl mercuric chloride, orthochlorophenol, benzaldehyde and 2-chloropyridine.

## PRESERVING INSULATION

Mold growth impairs the function of electrical equipment (1) by bridging of terminals and causing electrical leakage, (2) by breaking down cellulose materials in the insulation, (3) by retaining condensed moisture and stimulating corrosion of metal parts. "Tropicalization" of electrical equipment by all manufacturers was insisted upon by the Signal Corps after bitter experience in the Pacific during military and naval operations. As much as 50 per cent of some signal corps equipment was reported to have failed within 30 days.

"Tropicalization" comprises the treatment of equipment with a protective fungicidal, moisture-resistant coating or redesign of equipment to eliminate the effects of fungus and moisture. The process generally resorted to in manufacturing electronic equipment for the armed forces was to impregnate parts with microcrystaline wax and to spray lacquer over the assembled equipment. The resins and plasticizers for the lacquer were selected from those not supporting mold growth. For extra assurance, fungicides were incorporated in the waxes and lacquers.

For the waxes, 1 per cent of the mercurials such as phenylmercuric stearate, phenylmercuric salicylate, and pyridylmercuric stearates were preferred. For the lacquers 10-15 per cent of salicylanilide or pentachlorophenol were utilized. Salicylanilide was preferred for it was less of a skin irritant and less likely to cause corrosion. The most recent method of tropicalization involves "potting" a whole circuit in an impervious resin.



**Simple container for calcium chloride dehumidifier. Parts are: waxed paper container, section of small diameter container, perforated disk, and cartridge of calcium chloride.**

## FOOD AND COSMETICS

In the field of food and cosmetics the use of fungicides is restricted by the possible danger to health involved. Instead, physical methods of mold control such as heat, cold, osmotic concentration, and ultraviolet light are substituted where possible. Ultraviolet light is effective in reducing air contamination in bakeries, mold growth on ointments, etc. The use of ultraviolet light is limited, however, since it does not penetrate many materials and is only effective as a surface antiseptic.

The following materials have been used as food preservatives although many of them are now prohibited by the Food and Drug Administration: benzoic acid, sodium and calcium propionates, parahydroxybenzoates, boric acid, salicyclic acid, sulfurous acid, monochloracetic acid, formaldehyde, cinnamic acid, hexamethylenetetramine and phenol. A wider variety of materials such as the hypochlorites, quaternary ammonium compounds, thiourea, and orthophenyl phenol are used in a fruit and vegetable wash to prevent spoilage in shipping and storage.

Benzoic acid, salicylic acid and sulphurous acid are highly effective only when in acid solution. The propionates have recently come into prominent use as bread mold inhibitors under the name "Mycoban" (Du Pont). As little as 0.3 per cent of the propionate in the flour will delay mold growth for a week—well past the fresh life of the bread. The ethyl and propyl esters of parahydroxybenzoic acid have been permitted for use in a large number of foods in Germany but are not approved in the United States.

The drug and cosmetic industry has become an excellent market for the methyl, propyl, and butyl esters of parahydroxybenzoic acid. These chemicals have been found to be efficient mold inhibitors for preparations containing starch, gums, and oils. The greater the size of the substituent group in this series of esters, the greater the effectiveness against micro-organisms but the lower the solubility in water. For aqueous preparations the methyl ester is employed in a concentration of 0.1-0.2 per cent, whereas for oil bases the butyl ester is recommended in a concentration of 0.02 per cent. Other preservatives are used in the cosmetic industry in the following percentages: benzoic acid, 0.1-0.2; formalin, 0.1-0.2; ethyl alcohol, 15-20; phenol, 2.0; sodium salicylate, 0.1; orthophenyl phenol 0.1; thymol, 0.1; and phenylmercuric compounds 0.001-0.002.

## FROM BUTTER TO FLOORS

There are many specialized applications for mildew-preventing chemicals. A few may be mentioned briefly.

The development of anti-fungal packaging materials for foodstuffs has been interesting. Treatment of parchment papers with calcium and sodium propionate for wrapping butter has been demonstrated to retard mold growth for several months. Propionic acid has been helpful in controlling mold growth in cheese when incorporated in the coating wax. A new development is "S-Coating" (Sterilite Products), which is a wrapping paper coated with a pigment made up of silver adsorbed on activated carbon. The activated carbon in this product adsorbs both oxygen and silver ions and keeps the silver in a microbiologically-active state.

Black mold on brick and concrete block houses in the South is a decidedly unsightly condition. The mold is a secondary infection, growing on dead algae. An organic water-proofing product for masonry walls, Ceraseal (Ceraseal Company), takes cognizance of this problem by fungiciding with 5 per cent pentachlorophenol. Experiments at this Station have shown that 0.1 per cent of mercurous chloride in a cement paint protects against mold growth. Copper compounds were effective fungicidally but interfered with setting of the cement.

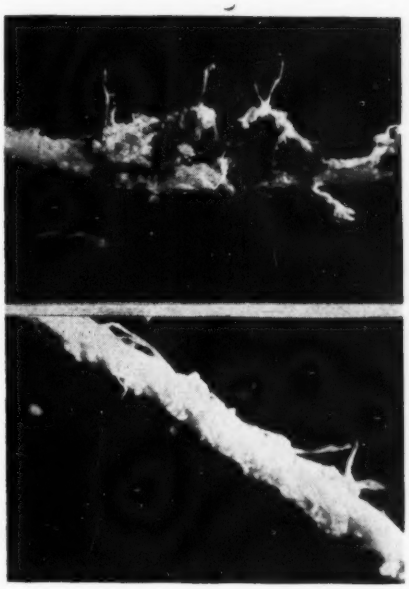
Deterioration of photographic film resulting from fungus attack was experienced by our armed forces in tropical areas during the war. Research at the University of Pennsylvania showed that the simple expedient of dipping the films in a bath of 0.1 per cent solution of a quaternary ammonium compound, "Roccal" (Winthrop), prevented mold growth

and did not have any deleterious effects on the film.

## WHAT ABOUT THE FUTURE?

The investigation of mildew preventives was stimulated by the war but mildew prevention is not restricted to military applications. A large potential market exists for many fungicidal products from book lacquers to fishing lines. Many manufacturers are now paying more attention to mildew-proofing.

The field of wood preservation is a large one, which has not been discussed in this paper. It utilizes large quantities of fungicidal chemicals for the prevention of rot and surface stain. Until the present time almost all of the treated



**Cotton strand, above, (x 30) devoured by fungus. Treated strand, below, is undamaged.**

wood has been taken by railroads and large industrial concerns. The home construction industry now offers a developing new market for quantities of preserved wood.

The present trend in fungicide development is in the field of the organics—toward the synthesis of potent fungicides that at the same time are not toxic to human beings. In the preservation of certain foods the development of new preservatives would be gratefully received. A case in point is the soft drink industry, where benzoic acid imparts an unpleasant taste to fruit beverages. Research in the antibiotics suggests that satisfactory ones will be developed.

One factor that will help greatly to advance the field of mildew preventives is the dissemination of research literature on this subject. This work was handled admirably during the war by the Tropical Deterioration Project, set up by the O.S.R.D. for this purpose. This organization is now continuing its fine work, which includes issuing the "Tropical Deterioration Abstracts," under the support of the National Research Council. The services of the Project, while designed primarily for the military departments, are available to industry as well.

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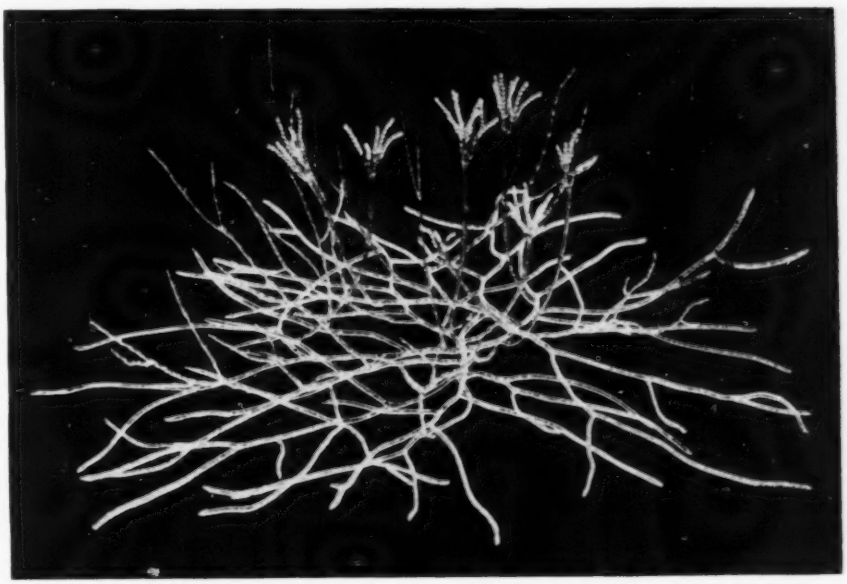


**Penicillium mold showing mycelia and spore-bearing hypha. Spores enable mold to proliferate. Model was prepared by the Chicago National History Museum, for laboratory studies.**

# Making 1080 Safe

## A case study in the safe manufacture and distribution of a hazardous chemical

by R. L. JENKINS* and H. C. KOEHLER**

**ALTHOUGH THE RODENTICIDE, 1080, is not as toxic to man as several other chemicals of commerce, its manufacture and handling are attended by unique safety problems, Monsanto's 1080 rule book—governing every step from raw materials to shipped product—is a case study in caution.**

THE PRODUCTION and distribution of a highly toxic chemical, such as the rodenticide 1080, poses numerous problems for the manufacturer. Safety in production and assurance that the product is used only by responsible persons in responsible organizations are primary considerations.

It should be said at the outset that, despite the many problems occasioned by high toxicity, it is possible to overemphasize danger to the point where a product can be banned even for uses in which it is less toxic than many others of its type. In some instances this has been the case with 1080, and the point is mentioned to emphasize the fact that any product, whatever its toxicity, can be handled readily and safely by responsible personnel acquainted with the proper technique for its use. Compound 1080 has been produced without mishap for several years, and a complete safety technique — from manufacturing through distribution—has been developed.

### SAFETY PROBLEMS

The problems involved in the production and distribution of such a toxic production and distribution of such a toxic product include:

(a) Personnel protection in using toxic raw materials.
(b) Development of a closed system which will isolate the material during manufacture.
(c) Personnel protection during packaging and shipping.
(d) Development of containers and labels to make certain that the material is correctly and safely shipped.
(e) Screening of customers to make certain that only reliable and responsible users receive the material.

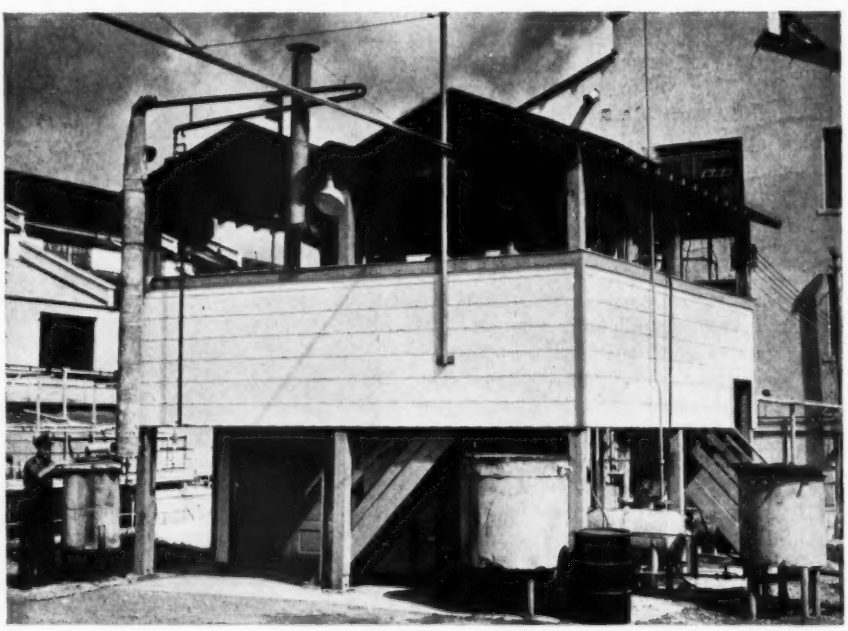
It might be important to explain at the outset that 1080 is the most effective all-purpose rodenticide known, since it is fatal to rats regardless of their species. It is also said to be the only rodenticide which will give almost complete eradication of all rats in a given location. It is the only rat poison which has been successfully used in water solutions rather than in bait, where it is not subject to variations in potency. Actually, there seems to be a tendency for rats to prefer poisoned water to pure water, although this has never been definitely proved.

The rodenticide was originally developed for the National Defense Research Committee, which required 500 pounds. Today, virtually the same equipment is used to supply the full commercial demand, which, because of the efficiency of the product, is only about 10,000 lbs. per year.

The outstanding features of 1080 appear to be high toxicity to all species of rodents tested, excellent acceptance, quick action, absence of objectionable taste and odor, chemical stability, nonvolatility, and no toxicity nor irritation on the skin of workers. Aqueous solutions are not absorbed through the skin. In addition, rats apparently do not develop any significant tolerance to 1080 on ingestion of sublethal amounts nor do they show significant reaction except after ingestion of lethal amounts.

### PROCESS STEPS

The basic raw materials used in the manufacture of 1080 are ethyl chloroacetate and potassium fluoride. The ester is lachrymatory, and consequently it is handled in a closed system of pipes throughout the process. When the drums in which it is received are opened and connection made, the operator wears a gas mask. It must be dry and contain no free acid, so the first process step is redistillation of the material.



Monsanto Chemical Company's pilot plant, at Anniston, Ala., for 1080 manufacture.

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Potassium fluoride must be dry and finely pulverized—the finer the better. Since it is hygroscopic and toxic, keeping it dry and keeping it from dusting into the air are major problems. It is first oven-dried, then pulverized in a mill and stored in air-tight cans until needed. Operators who do the grinding wear special suits and masks, and the mill installation is made as dustproof as possible. The latter is accomplished with special exhaust fans and by washing down the surrounding area after each grinding operation.

The two raw materials react in a well-stirred autoclave at 200°C. and a maximum pressure of 400 p. s. i. The reaction takes about 11 hours:

$$C_2H_5OOCCH_2Cl + KF \longrightarrow C_2H_5OOCCH_2F + KCl$$

The ethyl fluoroacetate is distilled off and then allowed to react in an agitated tank with a methanol solution of sodium hydroxide. The ester is thereby saponified and sodium fluoroacetate (1080) crystallizes out:

$$C_2H_5OOCCH_2F + NaOH \longrightarrow NaOOCCH_2F + C_2H_5OH$$

The slurry containing the product is centrifuged. The cake of 1080 is then dried —in thin layers on alloy pans—in a vacuum tray drier and screened before packing. It is usually stored in drums for later packaging.

The intermediate ethyl fluoroacetate is a liquid and is highly toxic. Therefore, great care is taken to prevent its escape into the plant area. To provide protection in case of a leak, all operators originally were required to wear gas masks on their hips to be handy when needed. However, with increased experience, this requirement has been changed to a rule calling for the placement of a large number of masks throughout the plant to be available immediately in case of necessity.

All of the liquids employed in manufacturing are handled in a closed system so that none of the toxic intermediate is allowed to escape. Very few leaks have occurred in the operation of the Monsanto plant, for the system is welded together wherever feasible. A check for tightness is made before each run.

## PACKAGING

A dust hazard is encountered with the final product, which is a fine, white powder. For that reason a specially constructed hood has been adopted for the packaging of the product. During the packaging operation the operators are provided with rubber gloves, aprons and boots and they also are required to wear masks when handling any of the material from the drying oven to the hood. It should be mentioned that the powder does not have any effect on the skin and several hundred milligrams would have to be inhaled before a fatal dose would be introduced into the body.

**Operator checks on reaction in autoclave, which is directly behind and to his right. Note the boldly displayed cautionary notice, one of several posted at various locations.**

Special metal containers with double friction-top closures are used for packing the material. Two sizes are used: one ounce and a half-pound, net. The cans are washed after they have been filled and closed in order to safeguard all those who handle the cans during routing. In the first days of the development of 1080 a great deal of difficulty was had in getting suitable containers, and one shipment was flown to Manila in fruit jars when no other containers were immediately available.

Cans containing 1080 are shipped in outside containers with net capacities of from one pound to 25 pounds. Each can has a wrap-around label and a circular label on the lid. The top label advises that the product contains a minimum of 90 per cent sodium fluoroacetate with a maximum of 10 per cent inert ingredients. The side label also warns boldly that the contents of the can are poisonous; brief initial directions for immediate first aid are given. It also advises physicians that sodium fluoroacetate exerts its action on the myocardium and central nervous system in primates and presumably in man, and that, aside from complete rest and adequate sedation to control central nervous system excitation, no therapy has been found to prevent the progression of cardiac symptoms in experimental animals.

Now the cans and covers are being stenciled so that, in the event that the wrap-around label should come off, the identity and poisonous nature of the product will be clearly indicated.

In any consideration of the safety aspects of handling 1080, however, it should be borne in mind that in water solutions—or most particularly in bait—the concentration is so low that it takes large quantities of bait to cause fatality to humans. Although 1080 is less toxic than many other poisons, as shown in the following table, deduced from animal experiments, safe handling requires the utmost caution.

| *Substance* | *Minimum Fatal Dose to Man (grains)* |
|---|---|
| Strychnine | 0.5 |
| Phosphorus (yellow) | 1.5 |
| Thallium sulfate | 2 to 5 |
| Arsenic | 2.7 to 3.2 |
| 1080 (for comparison) | 8.7 |

The coloring of bait, as well as the coloring of 1080, has been discussed at various times and, to date, Monsanto has not colored 1080: the larger users, particularly the government, want to do their own coloring because they use the product in a number of different applications. But there are numerous safety possibilities in the use of color. The Fish and Wildlife Service of the Department of the Interior has reported that certain colors serve as (1) a satisfactory re-

## SAFETY INSTRUCTIONS FOR THE MANUFACTURE OF 1080

### GENERAL

1. Only persons necessary to the operation are permitted in the area.
2. Two men must be on the job at all times.
3. Gas masks are spotted at several well-marked locations in the plant. Know where they are.

### DRYING AND GRINDING OF KF

1. Wear respirators during grinding.
2. Wear cotton caps, shirts and pants during the entire operation.
3. Operate exhaust fan during grinding.
4. Have protective clothing washed at the end of each shift.
5. Wash with a hose the mill and floor area after grinding operation is finished. Floor must be kept clean at all times.

### DISTILLATION OF $EE_3$ (Ethyl Fluoroacetate)

1. $EE_2$ is an intense eye irritant. The operator must be extremely careful not to spill the material.
2. Wear gas masks while changing from the forerun to product receivers and while connecting charge drum to the still.
3. If $EE_2$ is spilled, spread caustic over the $EE_2$ and pour a small amount of water into the pan, and wash out through the drain to the decontaminating system.

### DISTILLATION OF $EE_3$ (Ethyl Fluoroacetate)

1. Gas masks must be carried during product distillation.
2. Masks must be worn while changing takeoff lines.
3. Treat spilled areas with caustic and wash thoroughly.
4. Do not permit anyone not connected with the operation to be in the area during handling of the materials.

### AUTOCLAVE REACTION

1. The fan must be turned on the autoclave area at all times.
2. Masks must be worn during charging .
3. The operator must be on the alert for leaks all during the run. If any leak appears that cannot be stopped while pressure is on, the run is to be stopped and the product removed.
4. It cannot be overemphasized that $EE_3$ in crude or pure form is a dangerous chemical which may give serious results to an operator who allows himself to be exposed. Wear gas masks at all times during product removal, and at start of washing, and if leaks are found.
5. Check temperature, pressure, and alarm system at regular intervals.
6. Open the autoclave through the safety system if pressure reaches 400 pounds. Normal runs at a maximum of 240° C. do not reach a pressure of 400 pounds. Such a pressure indicates the reaction is not going well, and the pressure must be released and the trouble corrected.
7. Do not permit anyone not connected with the operation to be in the area during handling of the materials.

### HYDROLYSIS (PREPARATION OF 1080)

1. Wear gas mask while connecting $EE_3$ container to feed line in main building.
2. If necessary to inspect hydrolysis tank during $EE_3$ addition, wear gas mask.

### PRODUCT CENTRIFUGING

1. Wear face shield, rubberized gloves, rubberized aprons and rubber covered shoes during operation. Clean off clothing before leaving area.
2. Clean area with hose at end of operation.
3. Use covered pan truck for transfer of moist 1080 to drying room.

### DRYING, SCREENING, PACKING

1. Oven temperature must not be over 85°C.
2. Handle dried material in hood with blower in operation.
3. Wear gas masks, rubberized gloves, rubberized aprons, and rubber covered shoes during dry material handling operations.
4. Wash entire drying room area and equipment immediately after handling dried material.
5. Wash protective clothing after handling the 1080.

pellent for birdlife, (2) a warning factor against using 1080 poisoned oats as stock feed, and (3) a bait marker in field operations.

### NRC RECOMMENDATIONS

The Rodent Control subcommittee of the National Research Council are largely responsible for the following general precautions in the use of 1080.

1. Compound 1080 is a fine, white, fluffy powder similar in appearance to flour, powdered sugar and baking powder. It has been suggested that a coloring agent be added, to identify the compound and to guard against its being mistaken for the above mentioned items. It should be stored in properly labeled containers.

2. Although 1080 is not volatile, dangerous amounts of dust may be inhaled. It is recommended that a respirator be worn when handling the pure dry chemical. The dust also may adhere to clothing; therefore it should be removed carefully to prevent danger to pets.

3. Compound 1080 is neither absorbed by nor irritating to the unbroken skin . . . [But] if the operators's hands are cut or bruised, protective gloves should be worn, as the compound is poisonous should it enter the body in this manner.

4. The principal danger is from the ingestion of this compound; none of it should be swallowed. The operator should not smoke or eat while working with 1080, in order to keep the hands away from the mouth. After handling, mixing or distributing 1080-poisoned baits, the hands should be thoroughly washed.

5. All weighing, measuring and mixing equipment, stock bottles, bait containers, and other accessories involved should be properly labeled. Such articles for handling 1080 should be washed immediately after use and reserved for work with 1080 only. This equipment and all poison stock and baits should be locked up when not in use.

6. Compound 1080 should be used only in commercial and business establishments and on guarded municipal dumps by carefully instructed, reliable personnel competently supervised. It is not recommended for use in residential areas or for distribution in places where the public might be exposed to it.

7. All pets should be confined or removed from the area to be poisoned and kept out until the entire program has been completed. Cats and dogs are highly susceptible to 1080, and are killed by eating freshly poisoned rodents or dried carcasses.

8. All stock supplies, equipment, and poisoned preparations should be kept out of the reach of irresponsible persons and children, pets, and livestock.

9. All carcasses of rodents destroyed with 1080 should be promptly burned or buried.

A focal point in the Monsanto program for the control of 1080 and in the insurance of its safe use lies in determining those qualified to buy it.

After the removal of wartime orders and restrictions governing the distribution and sale of 1080, Monsanto reviewed its sales policy with a view to tightening restrictions which already had been placed on the material.

### CONTROL OVER USERS

It was anticipated that the largest demands (other than those of the Federal Government) would come from two sources: (1) pest control operators and (2) agencies of state, county, and city governments. Monsanto therefore formulated special statements and agreements for each of these two classes of sodium fluoroacetate users. Each pest control operator is required to sign such an agreement and to provide a certificate of insurance stating that the operator carries a minimum of $50,000—$100,000 public liability insurance for exterminating operations. A different type of agreement obviously had to be formulated for the other major class of users. In their case the agreement states that the agency will absolve Monsanto from any liability occasioned by the use of sodium fluoroacetate purchased from the company.

The agreements in connection with the purchase of the product provide that 1080 cannot be resold or packaged for

resale or use by others outside the company or agency to which Monsanto agrees to sell it. Signers of the agreement specify also that they are familiar with the poisonous qualities of sodium fluoroacetate and that they are familiar with safety instructions issued by the National Research Council. The agreement also provides that compound 1080 will be used only by persons experienced in and familiar with the dangers and uses of poisons, and that the customer organization will contact Monsanto's home office for disposal of any 1080 in original shipping containers which is no longer of use to the purchaser.

It is patent that any product, whatever its toxicity, can be handled with complete safety by competent operators. Responsible direction of its handling and use must be strictly exercised at all times. Immediate direction is exercised by Monsanto in 1080 production from raw material to finished product. When the product leaves Monsanto's hands, every effort is made to insure that the product goes only to responsible users.

**In addition to his clothing, the operator is protected by an efficient draft in the hood, which carries away toxic 1080 dust particles during the hand-weighing and packaging step.**

# Substituted Styrenes Modify Polymer Properties

by FRANK W. REINHART
National Bureau of Standards, Washington, D. C.

**COPOLYMERIZATION OF STYRENE DERIVATIVES with monomeric styrene alters molecular architecture, improves polystyrene for some applications.**

A GENERAL discussion of the factors and principles involved in the chemistry of styrene resins, presenting the salient features of the subject, should be particularly helpful as a review to those interested in their industrial or commercial applications.

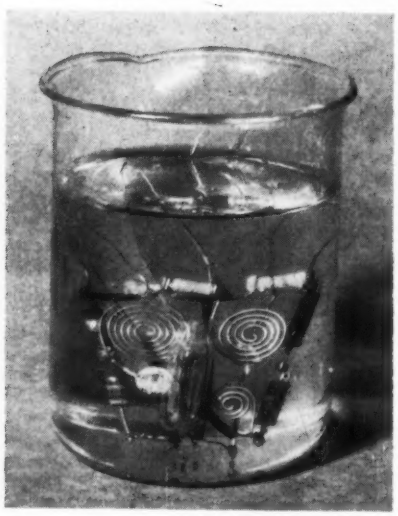
The first recognition of the commercial possibilities of styrene are noted in British Patent No. 16,278, issued in 1911 to Mathews, an English chemist. The plastic, polystyrene, was first put into commercial production in Germany in 1930. The first American product appeared in 1933 but was withdrawn after a few years principally because of the high cost and the yellow color. American production was again resumed in 1937 by another company and the production, quality, and applications have grown continually since then.

The long delay between the realization of the commercial value of polystyrene in 1915 and the actual permanent achievement of this goal in 1937 is attributed to several factors: First, the lack of an inhibitor to prevent polymerization of the liquid styrene during storage, shipment, and processing. This was solved in 1922. Second, the high cost of the production of liquid styrene. Third, the poor quality of the polystyrene as evidenced by its yellow color, poor aging stability, and low molecular weight with the resultant poor physical properties. The poor quality is now known to be in no small part a result of impurities in the liquid styrene. An economical process for making styrene of a high degree of purity was put into operation in 1937. Very pure styrene is now made in large quantities and is used mostly in making polystyrene and synthetic rubber. Information on the history of the commercial development of styrene and polystyrene has been published.[4, 5]

The most important method for synthesizing styrene consists of treating benzene with ethylene in the vapor phase in the presence of suitable catalysts to give ethylbenzene. This in turn is catalytically dehydrogenated to styrene at high temperatures in the presence of suitable catalysts. Styrene can also be obtained by cracking isopropylbenzene. In another process, styrene is one of the resultant products when crude oil is cracked by spraying against hot refractory brick. Some is also obtained as a byproduct of the water gas industry. There are many other methods of scientific interest but the ones described are the principal commercial sources.[4, 5]

The polymerization reaction is accelerated by heat, light or catalysts. The time required to polymerize styrene by heat alone at room temperature is of the order of several months. At 60°C. a month or more is required, and at 180°C. a few hours. The upper temperature limit at which polystyrene will form is about 300°C.; above this point the polymer decomposes to give monomer. Light, particularly blue and ultraviolet, also accelerates the polymerization; the time required to polymerize is of the order of a few hours.

The most used chemical catalyst is benzoyl peroxide. Other organic peroxides such as lauryl peroxide, *p*-chlorobenzoyl peroxide and *tert*-butyl hydroperoxide are also used. Metal and metalloid halides, such as aluminum chloride, stannic chloride antimony pentachloride, boron trichloride, and boron trifluoride, are also effective catalysts for this reaction. Other compounds which



**A new casting resin contains divinylbenzene and dichlorostyrene in addition to styrene.**

**A casting after polymerization is complete.**

have been used experimentally include hydrofluoric acid, phenyldiazonium fluocentrated sulfuric acid, chromic acid, hydrofluoric acid, phenyldiazonium fluoborate, iodine, mercaptans, sulfur dioxide, sodium, sodium malonic ester, sodium bisulfite, heavy metal carbonyls, lead tetraethyl, and oxygen.

Inhibitors for the polymerization reaction include compounds with quinoidol, nitro, phenolic hydroxyl, amino and nitroso groups. The most commonly used inhibitors are hydroquinone and *tert*-butyl catechol. Inhibitors which have been of interest to investigators are sulfur, benzoquinone, trinitrobenzene, anthracene, cresols, pyrogallol, paraformaldehyde, hexamethylenetetramine, phenylnaphthylamine, phenylacetylene and pyrogallol.

The rate at which the polymerization reaction takes place has a marked influence on the average molecular weight of the polymer produced. In general, the faster the rate of polymerization, the lower the molecular weight of the polymer. There are a few inhibitors, however, which reduce both the rate of polymerization and the molecular weight of the product. Examples of this group are phenylacetylene, benzoquinone, hydroquinone, carbon tetrachloride and thiophenol. The average molecular weight of the polymer formed at the beginning of the polymerization under a specific set of conditions is the same as that of the polymer formed at the end of the polymerization.

There may be a wide spread or distribution in molecular size[1, 2, 3] around the average under most conditions of polymerization. Narrower distributions can be obtained by separating the product into groups of different molecular size by processes such as fractionation, which is a tedious, time-consuming process.[1, 4, 8]

## MECHANISM OF POLYMERIZATION

A better understanding of the formation of polymers will result from a little deeper insight into the mechanism of polymerization. This reaction can be divided into at least three main steps, all of which may be occurring at the same time in a polymerizing system. These are initiation, propagation and termination. The initiation step consists of activation of the double bond so that an unactivated molecule will add. This reaction is extremely slow.

The propagation reaction consists of further additions of monomer to the activated molecule to produce larger polymers. This reaction is very fast and exothermic. Since the reaction is exothermic, energy considerations are not a factor in making this reaction possible; but the heat generated in a large bulk will raise the temperature and increase the rate of polymerization sometimes to one of explosive violence unless means are taken to remove the heat. One obvious method to maintain a fairly uniform temperature during polymerization is to make the polymer in particles of small bulk, such as by emulsion polymerization. Another is to control the overall rate of the reaction at a value such that the heat can be removed as fast as it is generated. In casting, the polymerization may be carried to the point where the material is a syrupy liquid, i. e., partially polymerized, and then poured into the mold and the polymerization completed so that the shape desired is obtained. This partially polymerized material must be poured before the gel structure has formed; otherwise the object will have low strength properties.

The termination rate is faster than the initiation rate and slower than the propagation rate. The termination reaction may be explained by several different mechanisms. These will be listed without any effort to consider the pros and cons of each. (1) Two growing chains of the polymer may unite at their activated ends. (2) An activated polymer molecule may unite with catalyst residues, impurities or solvents. (3) There may be an intramolecular shift in the activated molecule itself, which would produce stability. (4) The activity may be transferred from a large activated polymer molecule to a monomer molecule. This may be considered a type of propagation. (5) An active molecule may unite with an inactive molecule and two inactive molecules be produced by hydrogen shift from one to the other.

There are experimental indications that in some cases branched chains are formed. Several mechanisms have been proposed to explain this phenomenon. The most probable one is that activated chains may unite in such a manner that side chains or branches are formed or may form by further polymerization.[1, 2, 3, 8, 9]

Polystyrene depolymerizes to give a moderate yield of the monomer styrene when heated above 300°C. A good yield in this reaction is of the order of 60 per cent. A large part of the by-product is a styrene dimer. Styrene obtained by depolymerizing polystyrene by heat must be purified before repolymerizing to obtain a good product.

## PROPERTIES OF POLYSTYRENE

The average molecular weight of solid polystyrene ranges from a few thousand to several million according to the method of preparation. The properties are a function of the molecular weight, although in the higher range there is little difference in some of the properties. The higher the molecular weight, the harder and less soluble is the product; the lower the molecular weight, the softer and more soluble the product. The softer commercial polymers used in formulating adhesives and coatings range in molecular weight from about 10,000 to 70,000. The harder commercial polymers used in molding compounds range from about 75,000 to 200,000. The usual commercial polymers are soluble in aromatic hydrocarbons, chlorinated hydrocarbons, and some esters and ketones. As the molecular weight increases, the number of compounds in which the polymer is soluble decreases. No sharp dividing line exists between solubility and insolubility; there is a stage between these two in which the polymer swells in the solvent. The higher molecular weight materials also have higher impact and tensile strength.

The properties of polystyrene may be modified to obtain certain desired values by the incorporation of plasticizers and fillers. The addition of plasticizers lowers the softening point, hardness, and modulus of elasticity, and increases the coefficient of thermal expansion. Fillers

have the opposite effects.[11, 12] The addition of mineral fillers is particularly effective in reducing the coefficient of thermal expansion, while the addition of both fillers and plasticizers affect the electrical characteristics of the resin.

The presence of electrically conducting, water-absorbing materials or compounds with polar groups in the plastic composition generally result in higher dielectric constants and reduced electrical resistivity.

## SUBSTITUTED STYRENES

Several substituted styrenes have been investigated. These include among others, the various methylstyrenes, 2,4-dimethylstyrene, *p* - ethylstyrene, *p* - isopropylstyrene, the trimethylstyrenes, the chlorostyrenes, *o*-bromoethylstyrene, the nitrostyrenes, the diphenylethylenes, the phenolic styrenes, the divinylbenzenes and the dichlorostyrenes.

*Divinylbenzene.* There are three isomers of divinylbenzene, the *o*, *m*, and *p* forms. *p*-Divinylbenzene polymerizes rapidly at 100°C., forming a hard, heat-resistant, brittle resin in 1 to 2 hours, whereas styrene requires 2 to 3 days to polymerize at the same temperature. The polymer formed is a cross-linked resin; i. e., not only are chains formed, but these chains are cross-linked into a network. A piece of this material is probably one large molecule; that is, all the chains are linked together by primary valence forces, although not in a perfect orientation. The polymer depolymerizes at 400 to 450°C.

The cross-linking as a result of the presence of two reactive units on the benzene ring of this compound has a marked influence on the properties of the resultant polymer. Polymers that consist of linear chain molecules only are generally thermoplastic; the cross-linked polymers are thermosetting. On heating to high temperatures at ordinary pressures they decompose before softening appreciably. Some materials such as phenolic resins, when in a partially polymerized form, soften when heated; but the heat completes the polymerization or cure and a thermoset material results.

The present concept and use of the terms thermoplastic and thermosetting have a broader meaning than the reaction of the materials to heat. Thermoplastic materials are softer, have a lower modulus of elasticity, a higher elongation at rupture, greater plastic flow or creep under stress, lower heat resistance, and higher coefficient of thermal expansion than thermosetting materials. The thermoplastics are generally soluble in some organic solvents whereas thermosetting materials are not. Thermoplastics are generally injection molded into dies which are relatively cool. Thermosetting materials are generally compression molded in heated dies and can be removed from the molds while hot. (A thermoplastic material would have to be cooled before removing from compression dies.) It should be noted that the differences between thermoplastic and thermosetting materials depend on the amount of cross-linking. Many polymers have properties intermediate between the two. It is doubtful if any of the polymers synthesized are completely thermosetting materials; they all probably flow at high temperatures and pressures.

Divinylbenzene may be copolymerized with styrene to form a copolymer. Staudinger and his associates published the results of work in 1934 to 1936 which describes this copolymerization. The additions of even small amounts of divinylbenzene to styrene causes a marked increase in the rate of polymerization and leads to some cross-linking. Depending on the amount of cross-linking, the properties of the copolymer are intermediate between those of thermoplastic and thermosetting materials. A few per cent of divinylbenzene in a styrene resin will increase the heat distortion point, modulus of elasticity, and solvent resistance. On the other hand, the electrical properties, refractive index, density, and ultimate strengths will be affected not at all or only slightly. As the amount of divinylbenzene is increased the moldability decreases.[1, 4, 5]

*Dichlorostyrenes.* Of the chlorostyrenes, those in which two chlorines are substituted for hydrogens on the benzene nucleus are of the most interest. Most of these dichlorostyrenes polymerize much faster than styrene to give a thermoplastic polymer. The heat resistance, flame resistance, chemical resistance and density of the polymers are greater than those of polystyrene. The impact strength is reported to be three times that of polystyrene. These polymers are very expensive when compared to the cost of most commercial plastic materials.[1, 4, 5]

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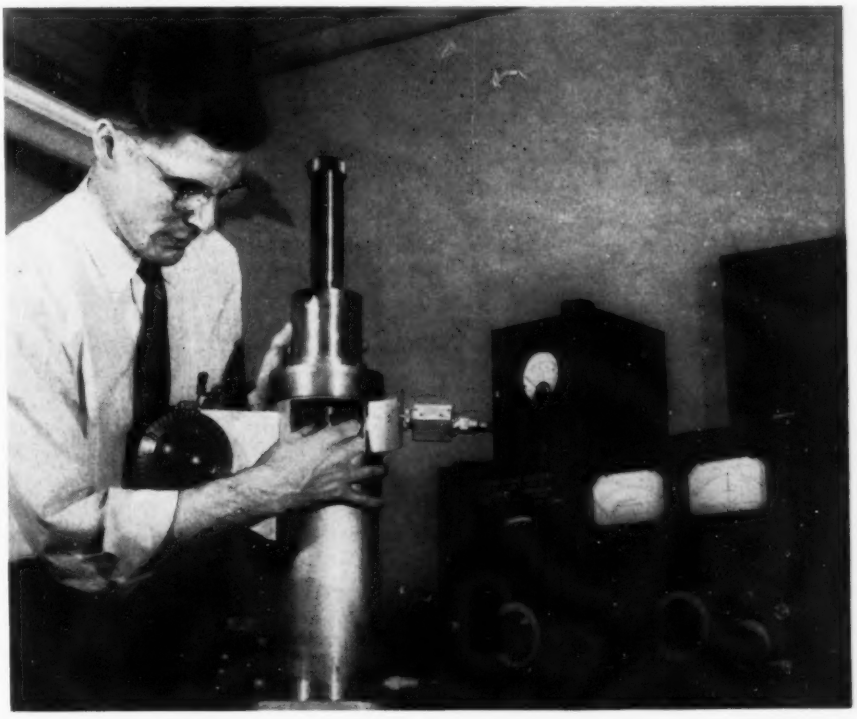
Based on a paper presented at the technical symposium on the NBS Casting Resin, National Bureau of Standards, October 16, 1947.

**An electronic circuit, "potted" in a casting resin composed of styrene and mixed styrene derivatives, is tested for electrical properties under controlled temperature and humidity.**

*Courtesy U. S. Rubber Co.*

# INSECTICIDE EMULSIONS

## Easier to Ship, Safer to Use

by G. ALLEN MAIL
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Jersey City, N. J.

**WATER IS CHEAP. BUT THAT IS NOT THE only factor favoring insecticide emulsions. Concentrates are economical to ship, and most emulsions are less toxic to animals than are solvent-type products. Too, as the author points out, there are good, recently established formulations which can serve as guideposts for further research.**

CURRENTLY, all insecticide formulators are exhibiting a keen interest in insecticidal emulsions, for, largely as a result of the introduction of new toxicants, emulsions seem destined to play an increasingly important role in pest eradication. One of the primary factors spurring this development is, of course, the fact that many of the newer insecticidal agents exhibit, in an oil solution, marked toxicity to higher animals and to plants. Thus, particular attention has been focused on wettable powders or water emulsions which can carry the same basic toxicant but still be used without any health hazard.

It cannot be said, however, that insecticide emulsions are new. Kerosene-soap and so-called miscible oils were first formulated fifty years ago and still find wide usage. Too, pyrethrum and rotenone emulsion concentrates have long been on the market, and they still enjoy wide sale—particularly for protecting home gardens from insect attack. Nevertheless, these old standbys are, to a large extent, being superseded by DDT, chlordane, Toxaphene and other synthetics for which scores of general and specific emulsifiers have been developed.

### WHAT IS AN EMULSION?

By definition emulsifiers are substances which aid in the production of, or increase the stability of, dispersions of one liquid within another. Emulsions may be of the oil-in-water (o/w) type in which small droplets of oil are suspended or dispersed in water, or water-in-oil (w/o) emulsions in which small droplets of water are suspended or dispersed in oil. Where it is desired to distribute a comparatively small quantity of oil over a large surface, oil-in-water emulsions are indicated, and this applies to insecticidal oils, or toxicants in an oil solvent or base.

An emulsion may be stable or unstable. The difference between the two lies mainly in the completeness with which the oil-water interface is filled with the emulsifying agent, and in the resistance to rupture the shell-like interface of this material offers. One that ruptures readily makes for a quick-breaking emulsion whereas a tough "shell" yields a stable product.

There are circumstances in which a quick-breaking emulsion is desirable, but for most insecticidal purposes a stable emulsion is required. Generally speaking, when an emulsion is so unstable that it breaks, forming separate oil and water layers, it is practically worthless as an insecticide. Possible exceptions might be in cases where high-pressure oil sprays are used against specialized crops or a single type of pest.

### CONTACT AND RESIDUAL TYPES

Before much was known about residual sprays the object of spraying plants with emulsified contact toxicant was to hit the insect itself. It was thought that contact sprays killed chiefly by their ability to enter the trachea of the insect, the outer wall in many cases being too thick and impervious to allow penetration. This tracheal penetration was demonstrated when certain tinted oils were used. Obviously, compounds that were ether-soluble or capable of dissolving fats when taken into the trachea, would undoubtedly

affect the insect adversely. However, some insects possess a mechanism to effectively prevent the entrance of solutions by closure of the trachae or expulsion of fluids, so rendering such treatments ineffective.

Another means of protection with certain insects is the waxy exudate or deposition on the integument. Against such insects the use of an emulsifying agent that is capable of dissolving this waxy covering, thus permitting the toxicant to exercise its effect, is prescribed. Certain emulsifying agents do, in fact, exhibit this property and they can be considered as insecticides in themselves.

With new synthetic insecticides, which are true contact poisons in that they function to paralyze or otherwise inactivate the nervous system, trachael blocking has little protective power, and such agents combined with a lipoid-dissolving emulsifier permit maximum activity on the part of the toxicant and increase its speed of action.

Toxicants with a marked residual effect such as DDT, chlordane and Toxaphene can kill if the insect merely crawls or walks over the dried spray residue. In the use of sprays containing such toxicants it is important that all of the leaf surface be covered. This involves the principles of spreading and adhesion. The presence of a wetting agent, which increases the run-off of spray materials from foliage, may result in there being a lower concentration of the toxic agent remaining on the leaves than in the spray that runs off. What is desired is a uniform, weather-resisting film with no droplets formed to leave uncovered or unprotected areas.

## STABILITY PROBLEMS

There is no hard or fast rule as to how long an emulsion must remain homogeneous before it can be considered stable. In Army tests of insecticides for the control of scrub typhus, emulsions of scaricides were used to impregnate clothing. An emulsifier in a strength of 10 per cent was considered satisfactory if no separation of the oil phase occurred within two hours after preparation. However, no separation within 24 hours was regarded as preferable. In many cases combinations of two emulsifiers have proved to give a more stable product than a single emulsifier. The combination of two emulsifiers, one of the oil-in-water type and the other of the water-in-oil type will often give a highly stable end product.

Too, inasmuch as emulsion concentrates may be diluted with water of every degree of hardness, it is preferable that emulsifiers be of the non-ionic type so that there will be no reaction with the salts of hard water.

Emulsions of the relatively new insecticides DDT, chlordane and Toxaphene occupy a valuable place in the insecticide field and considerable attention has been given to peculiar problems raised by their emulsification. There are many DDT emulsion concentrates on the market, these being largely 20, 25 and 30 per cent DDT emulsion concentrates, although the 25 per cent concentration appears to be the most popular. The stability of the diluted emulsion depends not only on the emulsifier employed but also on the DDT solvent used. The emulsifier is present usually in the proportion of from 4 to 6 per cent by weight and improved performance is often obtained by the use of two emulsifiers. Although about 70 per cent of the emulsion concentrate is solvent, the final dilution is so great that there is little danger of plant or animal injury by the use of this insecticide. In DDT emulsion concentrates, there must also be considered such problems as the ability of the DDT to remain in solution at low temperatures. This is, however, a problem of the solvent used rather than the emulsifier.

## DDT FORMULATIONS

Most DDT emulsions, on dilution with water, form a milky solution. As such emulsions are used to a large extent around dairy barns, one prominent manufacturer of insecticides has incorporated a blue dye in the emulsion concentrate as a safety factor, so that a pail of the diluted insecticide will not be mistaken for a pail of milk.

Wettable powders containing DDT might also be mentioned, for, although they do not yield true emulsions the suspensions they do form can be reasonably stable. One colloidal-type formulation, for instance, containing 10 per cent DDT, 10 per cent surface-active agent and 80 per cent other ingredients, has been found to remain stable for almost 24 hours.

## CHLORDANE COMPOSITIONS

Chlordane, unlike DDT, is highly soluble in paraffinic solvents, thus permitting economical emulsion formulations to be made with kerosene as the solvent. A typical concentrate, containing approximately 40 per cent by weight of chlordane, would be:

Chlordane . . . 1.00 lb.
Emulsifier . . . 0.25 lb.
Kerosene . . . . Sufficient to make the specific gravity of the solution equal to that of the water employed.

It has been noticed, and appears to hold true for most insecticidal emulsions, that the more nearly an emulsion concentrate approaches the specific gravity of water, the more stable is the final dilution. If an emulsion should lack the desired stability it may be improved, on occasion, by increasing the concentration of the emulsifier. This is not, however, an infallible remedy.

## CONTAINER WORRIES

Chlordane emulsifiers have recently been introduced for the preparation of concentrates in which no auxiliary solvent is employed. Such emulsifiers, when mixed with an equal weight of chlordane, do not make typical milky emulsions but rather clear colloidal dispersions. Examples of such emulsifiers are Trex 80 and Nopco HBX. A concentrate comprising Trex 80, 50 per cent by weight and chlordane 50 per cent by weight diluted to make a 2 per cent emulsion in water, results in a clear, sometimes faintly opalescent, golden colored liquid. Such colloidal dispersions have proved to be physically stable at room temperature and on accelerated tests in the oven at 120° F. over three months have shown no sign of breaking.

As some manufacturers have considered marketing a 2 per cent water emulsion of this nature, ready for use by the ultimate consumer, it might be of interest to consider such a product. There is, in 2 per

**Many manufacturers are now turning out emulsions for household use, find that consumers are impressed by the economy of buying a concentrate which can be simply diluted with tap water.**

cent chlordane emulsions, after a relatively short period, a definite increase in acidity. Freshly made 2 per cent emulsions of chlordane-Trex 80 usually have a pH of around 7 but after some weeks they appear to stabilize at a pH of between 2 and 3, both at room temperature and in the oven. The addition of 0.1 per cent by weight of sodium bicarbonate prevents a drop in pH over a four week period at room temperature but in the oven the pH drops from 7.0 to 5.8 in that period. This apparently is an excess of $NaHCO_3$ as a considerable precipitate is formed on standing. Addition of 0.006 per cent by weight of $NaHCO_3$ not only prevents a drop in pH but on mixing with the emulsion results in a very tenacious foam which can complicate plant operations.

There is, in any event, an element of doubt as to the value of attempting to stabilize a chlordane-Trex 2 per cent emulsion by the addition of $NaHCO_3$. In the presence of adequate amounts of $NaHCO_3$ the free HCl liberated by the hydrolysis of the chlordane will be neutralized but this will not in any way prevent a theoretical degradation of the toxicant, may in fact tend to speed it up. What is required is not a neutralizer but an inhibitor. This raises the question as to the necessity of maintaining the pH near neutrality.

Biologically, a chlordane-Trex 80 2 per cent emulsion after 2 months at 120° F. is apparently just as active as the same material kept at room temperature, and there is no apparent loss in toxicity. Of course, from the container standpoint the pH is highly important as an emulsion of such high acidity as pH 2 cannot possibly be packaged in tin. Not only does the can rust but the emulsion breaks and leaves a water-white supernatant liquid with a tarry residue in the bottom of the can. In glass, of course, this situation does not obtain.

A Trex 80-chlordane concentrate, sold as such, to be diluted by the ultimate consumer to any desired concentration should be a very valuable addition to the list of useful insecticides. Such a concentrate, in common with DDT and Toxaphene concentrates, cannot, of course, be packaged in tin.

An effective chlordane concentrate, sold under the name of Ridz Dog Tick Wash, makes a different type of emulsion of high stability though not as stable as that just discussed. This formula utilizes two emulsifiers, and two oils—mineral seal oil and an oil of plant origin. (*C. I.*, Dec. '47, p. 976.)

Some emulsifiers have been developed that will permit the use of up to 70 per cent chlordane in a concentrate. A typical formula for such an emulsion concentrate would be chlordane, 70 per cent; mineral oil, 15 per cent, and emulsifier, 15 per cent. Some of these emulsions are highly stable and very easily dispersed after standing for a considerable time.

## TOXAPHENE EMULSIONS

Toxaphene, which is a chlorinated camphene, is a cream colored, waxy solid with a mild piney odor. It melts in the range of 65° to 90° C. While its waxy nature and its density of 1.6 might suggest that it would offer difficulties in the way of emulsification, its extreme solubility in a wide variety of solvents makes emulsification a relatively easy matter. In xylene, for instance, over 450 grams can be dissolved in 100 milliliters at 27° C. and even in deodorized kerosene over 280 grams will be taken up in 100 milliliters. Emulsification is further simplified by the fact it can be heated to 100° C. without breaking down and with no loss of biological effectiveness.

Many of the usual insecticide emulsifiers do not work so well with Toxaphene though a few make fairly stable emulsions. However, several manufacturers are now working on the problem of emulsifiers that have a special application to Toxaphene, such as Griffin Chemical Co.'s Trem-014 and R-170. Also, many of the emulsifiers that work well with chlordane give good results with Toxaphene when formulated in the same proportions. The finished emulsions do not have the same appearance or physical properties. For example, a Trex 80-Toxaphene concentrate on dilution to make a 2 per cent spray, forms, instead of the clear colloidal dispersion obtained with chlordane, a highly stable white emulsion with less than 1 per cent of settling out after several days.

## BENZENE HEXACHLORIDE

In agricultural usage Toxaphene appears to have its greatest application when incorporated in a dust or a wettable powder, but for certain insects, and especially the home garden, it is probable that its emulsion concentrates will gain in popularity.

Another synthetic insecticide which has proved of considerable value in agricultural practice is benzene hexachloride. Early experiments with this toxicant yielded very inconsistent results but further research showed that its insecticidal action was due almost entirely to the presence of the gamma isomer. This insecticide, therefore, is now sold on the basis of its gamma content, and insecticidal formulations are based on this fact. The pure gamma isomer is at present being produced only in laboratory quantities.

## ROSEATE OUTLOOK

Emulsions of benzene hexachloride can be made by dissolving the material in a suitable organic solvent, then adding an emulsifier to give a solution of the desired concentration. A typical formula would be: benzene hexachloride (10 per cent gamma), 20 per cent; solvent, 70 per cent; emulsifier, 10 per cent. Such concentrates, on the addition of water, give a solution of sufficient stability for use in the field.

The past few years have witnessed the introduction of a large number of new toxicants, and several, notably but not only the ones referred to, possess robust promise. In solvent and dust formulations these new agents have proved their worth, have been enlisted as heavy-tonnage additions to our arsenal of pest eradicators. Now, with more and better emulsifiers being created, new avenues are being opened up, new opportunities are being presented for both manufacturers of these basic chemicals and formulators of insecticidal specialties.

*Courtesy Geigy & Co., Inc.*

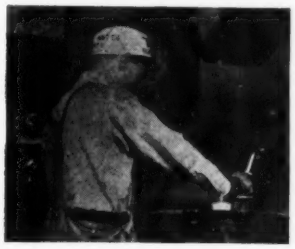
**Vast quantities of insecticide emulsions were used by the Army, largely because of shipping convenience. Now a heavy gallonage is consumed in the preparation of dairy sprays, etc.**

A CI REPORT ON

# DRYING OILS

## Part 2: Modified Natural Oils, Synthetics

by GEORGE M. SUTHEIM*



**HELPING THE CHEMIST TO OVERCOME the inherent deficiencies of natural drying oils are new techniques of separation and chemical modification. In the offing, but still requiring further research and development, are synthetic oils based on coal and petroleum. Potentially more fruitful, the author believes, would be a changed research emphasis, directed to the synthesis, not of oils, which are but raw materials for finishes, but of the finishes—the ultimate products—themselves.**

UNTIL recently, drying oils were used without any extensive modification. Some improvements in the natural product were made through the addition of driers, by bodying and blowing the oils, or by blending them with other ingredients. Retrospectively, it is evident that this was not the best that could be done, but even so the methods then developed are still extensively used today. The results in the foregoing era were obtained by rather empirical methods, since little was known about the structure of the drying oils and the mechanism of molecular growth.

But at the present moment in the history of drying oil technology, we are in what may be called the "era of the modified natural oils."

## MODIFIED OILS

In the meantime research has caught up with empirical practice; chemists and physicists are no longer satisfied merely to tinker with the oils. Oil molecules are systematically taken apart and recombined with or without new constituents. If convenient the pattern suggested by the natural model is followed; but if necessary the scientists do not hesitate to disregard Nature's advice altogether and to create molecules never found in natural drying oils.

### ACTION OF DRIERS

Certain metals, when added to the drying oils in very small percentages in the form of their oil-soluble organic salts, have an astounding accelerating effect upon the speed of drying. These salts are commonly known as *driers;* hardly ever are drying oils used without them.

The drying acceleration for a given oil is dependent upon (1) the type of metal used, and (2) the quantity introduced. In reference to the first point, students of driers have repeatedly tried to evaluate the relative efficiency of the different metals:

| (*a*) | (*b*) | (*c*) | (*d*) |
|---|---|---|---|
| Cobalt | Cobalt | Cobalt | Cobalt |
| Manganese | Manganese | Manganese | Vanadium |
| Lead | Lead | Chromium | Manganese |
| Cerium | Cerium | Nickel | Lead |
| Chromium | Iron | Iron | Chromium |
| Iron | Copper | Platinum | Iron |
| Uranium | Nickel | Palladium | Copper |
| Sodium | Vanadium | Lead | Zinc |
| Silver | Chromuim | Calcium | Calcium |
| Zinc | Calcium | Bismuth | Aluminum |
| Mercury | Aluminum | Barium | |
| Aluminum | Zinc | Mercury | |
| | Tin | Uranium | |
| | | Copper | |
| | | Zinc | |

(*a, b, c* quoted from Chatfield[3], *d*, from Klebsattel[43])

As can be seen from these lists, there is agreement only that cobalt is the most efficient metal. From there on the evaluation differs widely. This bewildering diversion of opinions is probably due to the difference in methods employed, and the difference in evaluation of results. For all practical purposes the list of drier metals is very short, viz., *cobalt, manganese* and *lead,* with some other metals (*zinc, calcium,* and *iron*) occasionally used as drying helpers. Though vanadium and cerium undoubtedly have interesting drier properties, they must be discarded at present because of their exorbitant price.

As to the second point—the quantity of drier metal to introduce—experience shows that minute additions have a tremendous effect. In the following example the approximate "dry-to-touch time" (in hours) of linseed oil at room temperature, is compared for different concentrations of the three important drier metals:[16]

| *% Metal* | *Cobalt* | *Manganese* | *Lead* |
|---|---|---|---|
| 0.00 | above 100 | above 100 | above 100 |
| 0.01 | 80 | 85 | above 100 |
| 0.05 | 8 | 14 | 80 |
| 0.1 | 4 | 8 | 74 |
| 0.5 | 4 | 7 | 36 |
| 1.0 | 4 | 7 | 20 |

Additions above a certain optimum have no increased effect; on the contrary, detriment to film properties is observed if too much drier is used. If the metal is used singly, the optimum (figured on the amount of drying oil present in the for-

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mulation) is somewhere between 0.05-0.1 per cent cobalt, 0.1-0.3 per cent manganese, and 0.4-1.0 per cent lead.[43]

Very seldom is one drier metal used alone, since experience shows that combinations of two or three metals give better results. It is known, moreover, that cobalt has a marked surface-drying action, whereas manganese and lead promote better drying in depth. From this angle also, combinations are preferable.

Different types of driers are possible according to the organic acid to which the metal is attached. A few decades ago resinates and linoleates were most widely used. Today other organic acids are more popular because they permit higher metal concentrations without causing an impractical viscosity. Among these are naphthenic acid, prepared from petroleum, and 2-ethylhexanoic acid, a synthetic compound yielding practically odorless driers.[54, 56]

Though the addition of driers to paints and varnishes has been known for centuries, we actually do not know how they work. Empirical knowledge, in this respect, has been far ahead of theory. It may be that the driers are true catalysts, i.e., they accelerate the oxidation without entering the reaction. On the other hand, it is also possible that they actually participate in the reaction, possibly by absorbing oxygen from the air, increasing their valence, and then yielding the oxygen to the oil. The fact that the important drier metals, Co, Mn, Pb, are known to change readily from lower to higher valence (and vice versa) supports this view; yet nickel, which has the same property and is in so many respects close to cobalt, is almost valueless as a drier.[34, 36, 43]

## BODIED OILS

Oil-bodying, one of the older methods of improving natural drying oils, has been known for more than a century. There are two distinctly different types of bodied oils: heat-bodied and blown oils, of which the former are the more important.

*Heat-bodied oils,* also called kettle-bodied oils or stand oils, are obtained by heating the oils in open kettles—or better, under an atmosphere of inert gas ($CO_2$, $N_2$) or under vacuum. Their use offers numerous advantages:

(a) Bodied oils yield paints of better flow and leveling properties.
(b) They dry harder and faster.
(c) The films formed are glossier and of generally improved resistance to wear and weather.
(d) The use of bodied oils permits the addition of cheap volatile solvents without yielding paints of unduly low viscosity.

Accordingly, a large proportion of all drying oils is used in bodied form, in spite of the extra cost the bodying involves. In addition to its line of raw and refined oils, the modern oil-crushing plant offers a series of bodied oils, varying in viscosity from slightly above that of the raw oil to almost solid consistency at room temperature. The varnish maker has the option either to buy these oils (at a constant premium above the market price of the raw oil), or to body raw oil himself. The former has the advantage of uniformity attending large-scale production; the latter offers more versatility since the cooking procedure can be varied, either by bodying oils in separate batches, or by bodying in combination with resins and other ingredients in the varnish kettle.

Bodying speed is decisive for the value of an oil: The faster an oil bodies, the more economical will its use be, since increased production speed saves money and permits better utilization of existing equipment. The natural drying oils show vast differences in this respect. Tung oil is the best; only a few minutes' holding at temperatures around 500° F. is necessary to produce the optimum viscosity for varnishes (e.g., 40-60 poises). Oiticica oil is a close second. Linseed oil, on the other hand, is a slow bodier; 8-12 hours' heating at temperatures around 600° F. is required to achieve what tung oil does in as many minutes. Many of the newer modified natural oils offer the advantage of rapid bodying.[3, 13]

*Blown oils,* also called oxidized oils, are prepared by blowing air in fine bubbles through oils at temperatures between 200-400° F. for several hours. Large quantities of oxygen (up to 20 per cent) are absorbed. Apparently the oxygen becomes attached to the double bonds, thus producing strong polar centers in the nonpolar chain. This effects a considerable change in the character of the oil: the viscosity increases, the color changes to a reddish-yellow, and the solubility in nonpolar solvents is lowered. Blown oils are, on the whole, inferior to kettle-bodied oils. But they wet pigments remarkably, making them valuable additions to poorly-wetting vehicles.[3, 13]

## OLEORESINOUS VARNISHES

Varnish-making, in a nut shell, is this: Oils dry relatively slowly to give soft but elastic films; resins, on the other hand, dry rapidly (by evaporation of the solvent) and produce hard but brittle films. By combining the two, one can vary the properties from those of the pure oil to those of the pure resin, through any desired stage.

Oleoresinous varnishes consist, in the main, of *oil, resin, solvent,* and *driers.* Variation of the oil to resin ratio is only one important factor. If to a given quantity of resin much oil is added, the resulting varnish is called a "long-oil varnish"; with little oil, a "short-oil varnish." Some fifty years ago, when no other raw materials were available than linseed oil, several natural resins (copals), and rosin, oil length was about all the varnish-maker could vary. Slow-drying, long-oil varnishes were cooked for elastic, weather-resistant coatings, and the user of these products had to wait 48 hours or more to see his paint job dry. For harder, faster-drying finishes, medium- or short-oil varnishes were prepared, which became brittle in relatively short time. Yellowing and loss of gloss were considered inevitable.

This situation was completely changed by the introduction of tung oil, whose incomparable drying properties permit formulation of finishes which dry rapidly (4-hour varnishes) without becoming brittle. Though tung oil has been known in this country since the middle of the past century, the public was reluctant to accept quick-drying varnishes: Tradition linked rapid drying with poor quality. In 1880 only 40,000 lbs. of tung oil was imported into the United States, in 1900 some 2.7 million lbs.; but in the 1930's the yearly average passed the 100 million-lb. mark. But the upward slope suffered a sharp reversal with the outbreak of war in China, and it was still worse off during World War II, when the meager supply had to be strictly allocated for war-essential purposes. It proved the unsoundness of relying, for badly-needed quick-drying coating materials, on imported tung oil alone.

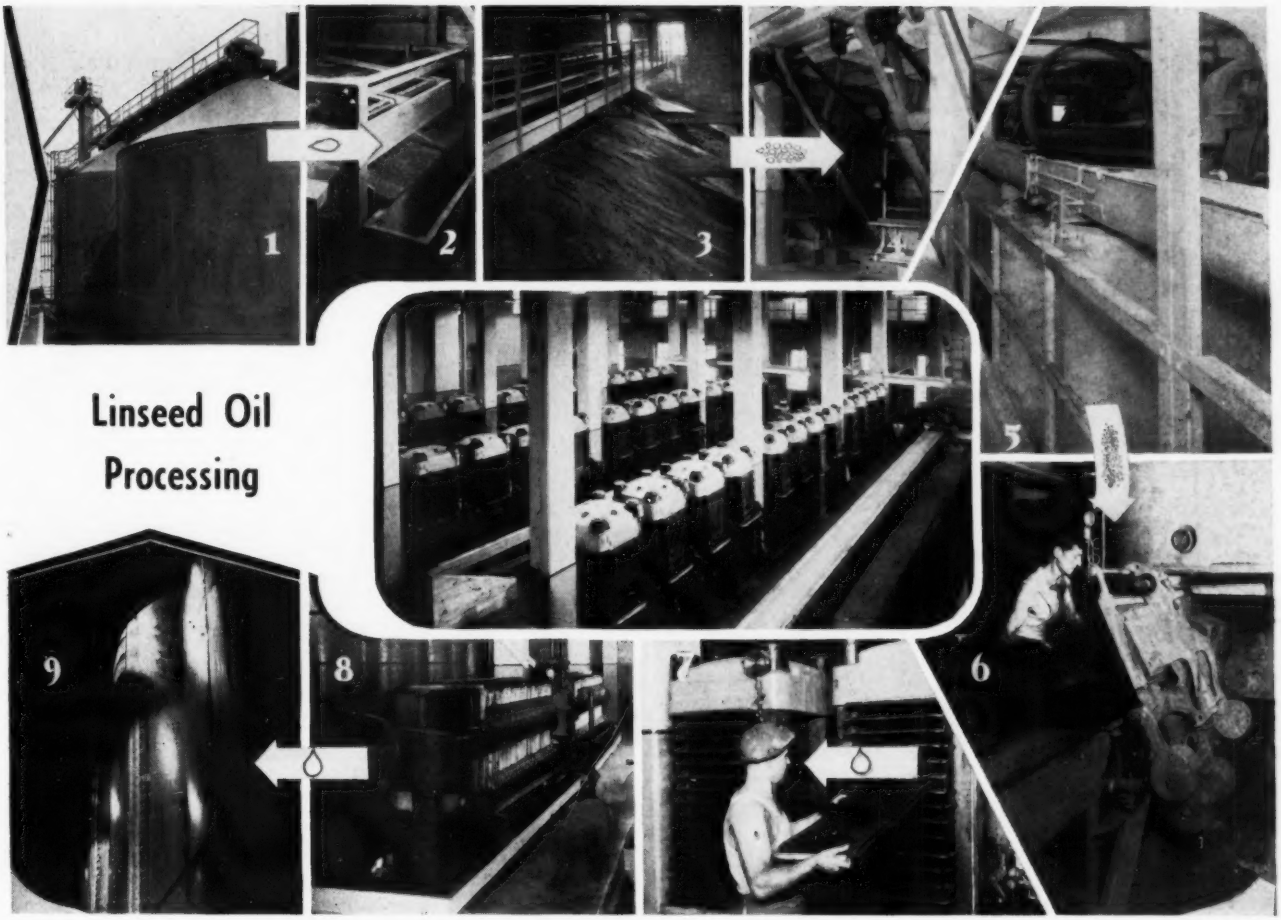
Solutions of the problem came from different sides: Successful attempts were made to cultivate domestic tung oil. Synthetic resins were developed which permit the use of "soft-drying oils" with almost as good results as those obtained with tung oil. Alkyd resins were used as never before. And the oil chemist came up with new oils, made by modifying the natural drying oils.[68, 76]

## FRACTIONATION AND SEGREGATION

As mentioned before, all natural drying oils contain varying amounts of saturated or low-unsaturated fatty acids with no drying value at all. If the percentage is small, as in tung or perilla oil, the good drying capacity of the bulk will "carry" the non-drying rest. (Some students even claim that such non-drying portions, remaining forever liquid, act as a plasticizer and improve the oil film's flexibility.) But if the proportion of non-drying constituents is large, as in soybean or cottonseed oil, the oil, now semi-drying oil, is not good enough for drying purposes and not quite right for other fatty oil uses. Taking the two portions apart thus becomes an important technical problem. Successful separation of the two portions on a technical scale is a development of quite recent date.[49, 70]

There are two different methods to effect the separation: distillation and solvent extraction.

(1) *Distillation Methods (Fractionation).* The difference in boiling points of the various fatty acids is utilized. To avoid the destructive action of high tem-




**Oil processing at a National Lead Co. plant is shown in this montage: (1) Flaxseed storage tanks holding 100,000 bushels; (2) Shaker screen for cleaning incoming flaxseed; (3) Storage bin for 20,000 bushels of cleaned seed; (4) Steel mills for grinding cleaned seed into meal; (5) Cookers in which meal is moistened and heated; (6) Forming cakes of flaxseed meal at base of cooker; (7) Loading oil press with mat-covered meal cakes; (8) Filtering oil from presses before aging period; (9) Indoor, constant-temperature storage and aging tanks in which oil mellows for six months prior to final processing, filtering and packaging; and (10) (center) General view of the linseed oil press room.**

perature, the distillation is executed under high vacuum (2 mm). It is necessary to split the oils first into fatty acids and glycerol, and to re-esterify the fractionated acids subsequently—a complicated and costly procedure. A new technique, *molecular* or *short path distillation*, permits fractionation, especially of bodied oils, without previous splitting. This method uses still higher vacua (down to 1-10 microns) and a very short distillation path (one-half inch to several inches).

(2) *Solvent Extraction Methods (Segregation)*. This method is based upon the difference in solubility of unsaturated and saturated fatty acids or oils in specially selected solvents, such as petroleum naphtha, methanol, propane, or furfural. Of particular interest is the solvent segregation of bodied oils. When oils of the semi-drying type are heat-bodied, only the highly unsaturated triglycerides body, whereas the rest remain practically unchanged; the unbodied oils are composed of smaller molecules and are more soluble, so that by virtue of the combined effect of gravity and selective solvent action the separation can be achieved.[35, 38, 44]

Segregated or fractionated oils show an improvement over the original oil only in so far as the poorly drying portions are eliminated. It is obvious, however, that the oils so treated can never be any better than the best drying portions of the natural oil.

## ISOMERIZATION OR CONJUGATION

In oil chemistry the term *isomerization* is specifically employed for the inner rearrangement of unsaturated oils which involves the shifting of isolated double bonds into conjugated positions. The theoretical possibility of improving nonconjugated oils through isomerization was recognized long ago, but no practicable method of inducing the double bonds to budge was known to the students of drying oils. It is one of the curiosities in the history of scientific progress that the first indication that this peculiar reaction can actually be executed came from an entirely different field. Biochemists had used ultraviolet absorptions spectra to detect new sources of Vitamin A; when oils, in the course of the analysis, were saponified with alcoholic caustic, a strange shift in the familiar absorption bands was observed. After prolonged studies the phenomenon was correctly interpreted and eventually reported in scientific papers as intramolecular rearrangement, i.e., isomerization.[51]

Based on these findings, the first method employed was to reflux nonconjugated oils with alcoholic caustic for many hours, split the soaps formed, and esterify the fatty acids with glycerol. The oils thus produced proved to be decidedly superior in drying speed. Bradley[26] found, on examining raw and treated oils, the following contents of conjugated acids:

| | *Per cent acids with conjugated double bonds* | |
|---|---|---|
| *Oil* | *2* | *3* |
| Raw linseed oil | 0.69 | 0.12 |
| Treated linseed oil | 35.2 | 9.7 |
| Raw soybean oil | 0.79 | 0.12 |
| Treated soybean oil | 43.8 | 2.2 |

For large-scale technical production this operation was too complicated and costly. Later on it was found that oils can also be induced to rearrange upon heat treatment with catalysts, such as certain metal oxides, activated nickel, or $SO_2$. Isomerized linseed and soybean oils are—though not quite a match for tung oil—a huge step forward.[20,59,69,73,74]

## DEHYDRATION

Dehydration is a technique which can be employed only with unsaturated oils

**At left, soy beans being weeded in a Chinese field. At right, a cake of soy meal after oil expulsion. It is used for cattle feed.**

which have an —OH group in the hydrocarbon chain. Among the natural oils available in quantity, only castor oil fulfills this requirement. Its main constituent, ricinoleic acid, is ideally suited for dehydration. If one molecule of water is withdrawn from this fatty acid, unsaturation can occur in either the 9, 11-position (conjugated) or the 9, 12-position (nonconjugated).

The dehydrated castor oil of commerce usually contains 17-26 per cent of the conjugated, 59-64 per cent of the nonconjugated, acid.[58]

Originally the dehydration was performed with ricinoleic acid (obtained by splitting castor oil) and the dehydrated acids were subsequently esterified.[63] This operation was too costly to permit the new oil to compete favorably with existing natural oils. Only after it was discovered that the withdrawal of water can also be achieved by heating castor oil with certain catalysts,[37] such as sulfuric acid, phosphoric acid, sodium bisulfate, or certain active earths, did dehydrated castor oil make its entrance on the market, causing no little sensation.

Today dehydrated castor oil is one of the more important paint and varnish oils. Its properties with respect to drying and bodying speed are between those of tung and linseed oil, but its color retention is superior to both of them.

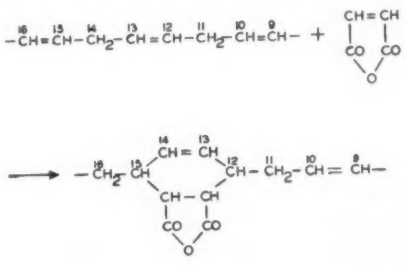
The principle of dehydration offers interesting prospects for future development. Though at present no other natural oil suitable for dehydration is available, it is quite possible that —OH groups may be artificially implanted in low-unsaturated oils. Subsequent dehydration would then yield valuable conjugated oils with drying properties.

## OTHER C=C REACTIONS

The unsaturated groups in the drying oils are, as indicated before, lively centers of reactivity; it was also mentioned that they are the linkage points for intermolecular growth. But numerous other reactions are possible, too, where functional molecules react with the unsaturated groups of the oils leading to the attachment of different groups.

One of these reactions, the attachment of oxygen to the double bonds by simply blowing air through the oil, has already been described. Chemically related is the treatment with sulfur and sulfur chloride, yielding the so-called sulfurized oils—rubber-like products known as "factis." Beyond these rather primitive reactions are other interesting oil derivatives made by attack on the double bonds, of which only two may be mentioned here:

*Maleated Oils.* If an unsaturated oil, e.g., linolenic acid, reacts with maleic anhydride at temperatures above 250° F., a "diene" reaction leads to the formation of an adduct:



The reaction product is a tribrasic acid (trifunctional), which can be esterified with polyhydric alcohols (tri-, tetra-, or higher functional). It is remarkable that the resulting oils, the so-called "maleated oils," though not of the conjugated type, show the cooking speed and the hard-drying qualities of conjugated oils. The high functionality of these products offers an explanation.[48, 49, 77]

*Copolymerized Oils.* When the almost miraculous achievements of the synthetic rubber chemistry became more commonly known after the war, oil chemists started to investigate the possibilities of applying the new principles in their own field. It was found that many of the monomers used by the rubber people, such as styrene, butadiene, and methyl methacrylate, also react (i.e., copolymerize) with drying oils. Whereas the copolymerization of styrene and butadiene leads rapidly to elastic, insoluble polymers (GR-S), the introduction of a fatty acid chain acts to interrupt the reaction at an early stage. The reaction between monomeric styrene and linseed oil, for instance, yields complex structures of definite oil character, and it is reported that these "copolymerized oils" are noteworthy improvements with respect to hardness of drying and alkali resistance. Wide possibilities for further development are opened in this direction.[41, 48, 77]

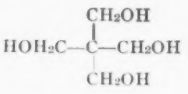
It may be mentioned here, that some of the more important reactions in the varnish kettle are also due to the reactivity of the unsaturated groups. The interaction between the oil-reactive (100%) phenolic resins and drying oils, which has been employed for many years to

produce hard-drying, alkali-resistant finishes, is an example.

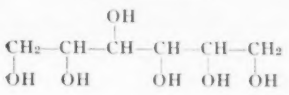
### POLYALCOHOL OILS

All methods described so far to improve drying oils have dealt with the hydrocarbon portion of the oil molecule. Here is one that starts from the other end: All natural oils happen to have their unsaturated fatty acids attached to the trifunctional alcohol, glycerol. According to the predictions made by the theory of functionality, molecular growth should be accelerated if alcohols of higher functionality were used instead of glycerol. This, in fact, proves to be true.[18, 28, 29]

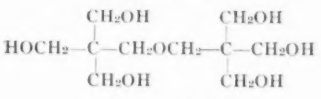
Among the alcohols available for the purpose we may mention:



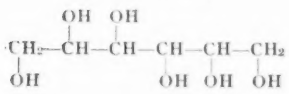
Pentaerythritol
(tetrafunctional)



Sorbitol
(hexafunctional)



Dipentaerythritol
(hexafunctional)



Mannitol
(hexafunctional)

A pentaerythritol oil thus starts out with a functionality 4/3, a dipentaerythritol oil with a functionality twice that of a triglyceride; accordingly, it might be expected that the bodying time of such oils be respectively ¾ and ½ that of the natural oil. It is interesting to compare these computed values with experimental results. Burrell[29] gives the following figures: Relative bodying time (from 2-15 poises) for a natural triglyceride = 1; for a pentaerythritol oil = 0.76; for a dipentaerythritol oil = 0.58. The figures agree remarkably well with the theory and show that considerable improvement can indeed be achieved by linking unsaturated fatty acids to alcohols of higher functionality. Moreover, films of such oils show greater hardness and better general resistance as a result of more cross-linkages and branchings.

### OIL-MODIFIED ALKYDS

Oil-modified alkyd resins, though they are no longer drying oils in the sense of the definition, are polycondensation products, in the architecture of which fatty oils have a share.

From the chemist's viewpoint an alkyd resin is the reaction product of a dibasic acid and a polyhydric alcohol, with or without fatty acids entering the reaction as a third constituent. The most popular dibasic acid is phthalic acid; others employed are maleic, succinic, and fumaric acids, each one yielding finished products of significantly different properties. Among the polyalcohols, glycerol is at present the most important, followed by pentaerythritol.

The reaction that leads to alkyd formation is, in terms of functionality, a bitrifunctional reaction (glycerol) or a bi-tetrafunctional reaction (pentaerythritol). The scheme of such reactions, as will be recalled from earlier discussions, is

$$n\,(xRx + \underset{y}{yR'y}) \longrightarrow xR - \underset{\underset{y}{R - R'y\ \text{etc.}}}{R'} - Rx$$

yielding spatial structures which run up to insoluble and infusible resinous bodies. The introduction of a fatty acid, which for this type of reaction is monofunctional, changes the course of the reaction in so far as many of the functional groups of the polyalcohol (y) are sealed up:

$$n\,(xRx + \underset{y}{yR'y} + zR'') \longrightarrow \underset{y}{(xR - R' - R'')_n}$$

Thus the self-propelling increase of functionality is slowed. In consequence, large molecules can be built up without running into insolubility and infusibility.

If the fatty acid introduced is of the nondrying type, nondrying alkyds result; these serve as valuable plasticizers in lacquers. If, however, fatty acids of high unsaturation are used, a variety of drying alkyds can be produced which respond to metallic driers in close similarity to heavy bodied oils or oleoresinous varnishes. Thus one finds on the market linseed, soybean, and dehydrated castor alkyds, depending upon the type of oil component introduced. The influence of a specific oil is not marked as in oleoresinous varnishes: even with a semi-drying oil, like soybean oil, alkyds of excellent drying properties can be manufactured. The oil is no longer an independent individual but a constituent of a new, complex molecule.[3, 9, 13]

Alkyd finishes have proved their merits under the most strenuous conditions. With respect to hardness, flexibility, and general resistance against wear and tear, they are among the finest we possess today in the field of surface coatings.

To merit the designation "synthetic drying oil," a material's constituents must not be derived from natural fats and oils. Therefore, all the examples cited up to this point have been referred to as "modified natural oils," and not as synthetic oils. This is more than a mere argument about a word. Even thoroughly modified oils, like the copolymerized oils or the alkyds, still bear the stamp of their natural origin in appearance, odor, and taste as well as in most of their chemical and physical properties. Only with regard to drying and bodying do they show noteworthy differences from their natural relatives.

## SYNTHETIC OILS

Synthetic drying oils are different from modified natural oils in this respect: The ester structure of all the natural fats and oils has important biochemical justifications; it is quite incidental that some of them also dry. Any structural configuration that has the proper type and number of functional groups is potentially capable of promoting molecular growth as well as, or possibly better than, the esters. Thus, synthetic drying oils are decidedly not limited to the ester structure of the natural model, with its inherent disadvantage (for coating materials) of being sensitive to hydrolytic decomposition.

*Synthetic ester-oils.* In spite of the well-known disadvantage of the ester structure, many attempts have been made, and are still being made, to copy Nature in producing synthetic drying oils of the ester type. Modern preparative chemistry permits synthesis of fatty acids of varying chain length and with almost any desired distribution of double bonds; by esterifying such acids with synthetic polyalcohols, purely synthetic ester-oils can be made. But such syntheses are complicated and costly and hardly show promise of competing economically with the natural product. It is reported, however, that some success in this direction was achieved by the Germans during the war. Hard pressed by excessive shortage of all sorts of fats, they produced (at a rate of 100,000 tons in 1944) synthetic fatty acids by catalytic oxidation of Fischer-Tropsch hydrocarbons. As a result, a mixture of fatty acids from $C_4$-$C_{28}$ was obtained which, after fractionation, was transformed into oils and alkyd-type resins. Apparently these oils were of only limited usefulness to the coating industry.[11]

### PETROLEUM SOURCE

*Petroleum-Drying Oils.* The most abundant source of cheap synthetic drying oils is petroleum, which contains a wide variety of olefinic hydrocarbons; moreover, numerous highly unsaturated hydrocarbons are formed when mineral oil is cracked. Following different methods, such as oxidation, chlorination, or catalytic polymerization, these hydrocarbons may be transformed into oily substances which show air-drying properties. On the whole, petroleum drying oils are cheap, but inferior to most of the natural drying oils.[45]

It may be mentioned that cracking of a variety of substances yields molecules

of high unsaturation which show the property of drying to a varying extent; for instance, terpenes, hydrogenated naphthalene, natural rubber, gutta percha, and many others; it is hard to see where these dark and evil-smelling products could ever become of technical importance.

*Polymerization Drying Oils.* The amazing results achieved in the field of synthetic rubber during the war proved that applied science is well capable of competing with Nature, in quality, in quantity, and even in price. Similar development in the field of drying oils could give us synthetics within the next few years. Today we don't have them.[55]

The work done in the rubber field offers an excellent starting point. Yet, the problems of synthetic rubbers and of synthetic drying oils are rather different:

A polymer, in order to show the typical properties of rubber (i.e., resilience, softness, insolubility, etc.), must be a linear polymer, with possibly a few cross-linkings, and of very high molecular weight. The polymerization must be carried to a point where only a few functional groups remain to permit a "cure."

A polymerization drying oil on the other hand, must be a soluble liquid of relatively low molecular weight, with many remaining functional groups ready to react when the time comes for drying or bodying.

Among the many monomers tried for the purpose are acetylene (and its dimer, vinylacetylene), butadiene and alkoxybutadienes, chloropropene, isoprene, styrene, and many others, as well as copolymers of these and other monomers. Under the name S.D.O. (synthetic drying oil), an oil-like polymer was made from vinylacetylene, which dried rapidly;[45] but the material was too unstable. It could be kept only in solution and under cautious exclusion of air, and the films formed had a tendency to become brittle. In fact, most of the polymerization drying oils investigated so far have suffered from one or several of the following disadvantages: lack of storage stability, incompatibility with other ingredients, insufficient solubility in aliphatic hyrocarbons, too dark in color, danger of spontaneous combustion, too rapid drying, too brittle on aging, after-yellowing, too high in price.

## FUTURE PROSPECTS

Less and less will the natural drying oils be used the way Nature presents them. Modifications, such as those described above, or others we don't know about as yet, will become so common that the user of oils will refuse to buy any but these superior oils; he will become aware that the premium he pays for the modified oils is a small price for reduction of the processing time, improved quality of the finished product, and not least—less trouble.

As our knowledge of oil chemistry increases, we shall not only see modifications of the natural drying and semi-drying oils, but also of the nondrying oils. The structure of the various types is, in fact, rather similar: all are triglycerides, mostly of $C_{18}$ fatty acids. The small, but all-important difference (from the viewpoint of drying) is the absence of functional groups in the nondrying oils. Many different ways of creating the missing functional groups are theoretically possible. One of them, the dehydration of castor oil, has already become a technical reality; but, as emphasized before, this method works only in the special case of castor oil. Methods of performing the transformation with other nondrying oils are presently being investigated on a laboratory scale; and in due time appropriate methods for large-scale production will evolve.

## PRICE AND SUPPLY

But there are still important nontechnical factors opposed to the immediate realization of the project: First, the question of price. The difference in price between nondrying and drying oils is not large enough to permit costly transformation operations. Second, the question of supply. Though about ten times the quantity of nondrying oils is produced every year as of drying oils, the demand for these oils (for food, soap, etc.) is greater than the supply, and there is, at present, no surplus available for large-scale transformation into drying oils. In both respects the situation may change. Oils of the nondrying type, cultivated in the tropical climates more appropriate for oil production than the temperate zones, bring much larger yields per acre than drying oils. (The yield of palm oil in the Dutch East Indies is reported to be more than 2,000 lbs. per acre, as against less than 200 lbs. of linseed oil per acre in the temperate zones.[39])

Thus a time may arrive when the raw material for the production of drying oils is no longer the natural drying and semi-drying oils alone, but any oil or fat, saturated or unsaturated, vegetable or animal. If this point is reached the users of drying oils may see one of their wishes come true: oils of fairly constant price.

Where do the prospective synthetic drying oils come into the picture? The natural fatty oils, raw or modified, are agricultural products, and as such, as discussed earlier, they have great disadvantages. Yet there is one advantage which probably outweighs all the disadvantages taken together: the fact that as a source of supply agricultural products are inexhaustible. As long as the sun shines and crops are harvested in the fields, every year will yield a new supply of natural oils. Not so with the synthetics. The ultimate raw material for almost any synthetic product is petroleum or coal, and whenever a pound of these materials is up, it is irrevocably gone.

Another point to consider is this: Is there any sense in attempting to synthesize a drying oil which, after all, is but a semi-finished product? The drying oils are hardly ever used as such; they must be blended with some other constituents to improve on drying speed, hardness, chemical resistance, etc. Wouldn't it be much more practical to work on a synthetic finished product, which, of course, would be something quite different from a drying oil? Instead of "synthetic drying oils," the goal would be "synthetic finishes," tailor-made to suit various purposes—at any rate something that no longer has to be bodied, or blended, or otherwise traditionally processed.

What properties would we, the users of today, want to see in these synthetic finishes of tomorrow? They should be:

(1) liquid enough to permit application without addition of (flammable) solvents;
(2) usable without further blending, treating in kettles, etc. (although slight adjustments may be acceptable);
(3) water-white in color, and entirely free of after-yellowing;
(4) odorless, or at least of mild and pleasant odor;
(5) of good wetting power for the commonly used pigments,
(6) non-flammable—or if that is impossible, of very high flash point;
(7) quick-drying to a hard, flexible film of high and permanent gloss and outstanding resistance to weather, abrasion, and the more common chemicals, including gasoline; and
(8) stable in storage.

It sounds like a lot! But if we compare the finishes of a century ago with what we have today, it does not seem like reaching for the stars.


## REPRINTS

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**Although drying-oil coatings are often used for decorative purposes, their main function in most cases is that of protection.**


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# Muffler Controls Discharge From Safety Disk

by N. W. FRANKE and M. W. KIEBLER
Coal Research Laboratory, Carnegie Institute of Technology
Pittsburgh, Pennsylvania

**NOISE, CORROSIVE SPRAY AND SPATTERED WALLS caused by the discharge from a rupture disk line are eliminated by a simple muffler, easily constructed from readily available materials.**

A 35-gallon pressure vessel, which is in operation in this laboratory at 1000 psig. pressure and 500°F., is protected by a ¾" safety disk. In the case of a disk rupture, the liquid and gas from the vessel were formerly carried vertically about 30 feet to the roof of the building by means of a 1¼" pipe where, after passing through a two-foot radius bend, they were discharged downward toward the roof at a 15° angle with the horizontal. The bend was so rotated that the stream struck an adjacent brick wall at about a 15° angle before touching the roof. During a discharge the large amount of corrosive fine spray produced was a source of potential damage to nearby property and, in addition, an unsightly fan-shaped deposit of solids was left on the wall. The noise which accompanied a disk rupture was also objectionable.

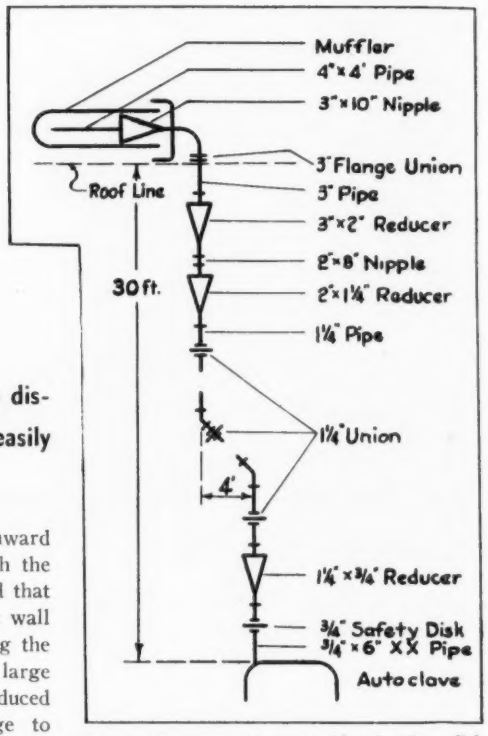



Fig. 1—Diagrammatic assembly of safety disk line and muffler.

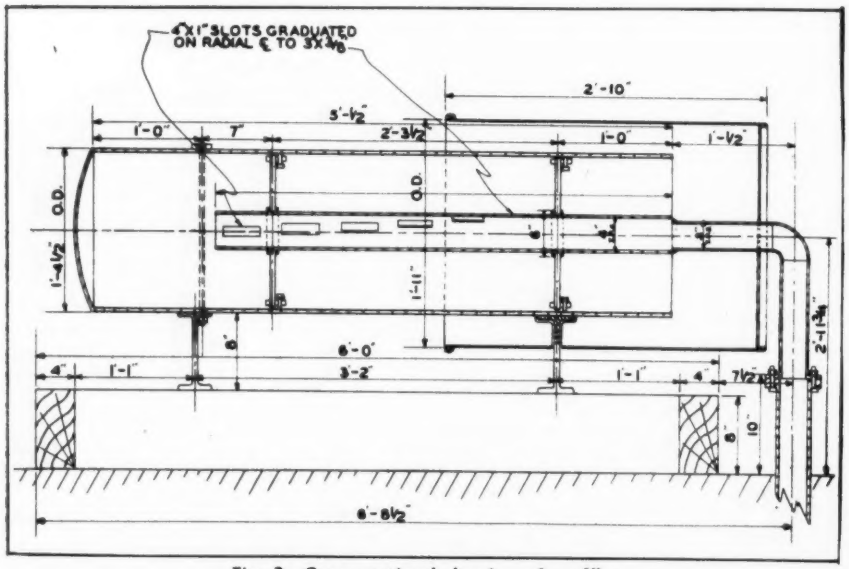



Fig. 2—Cross sectional drawing of muffler.

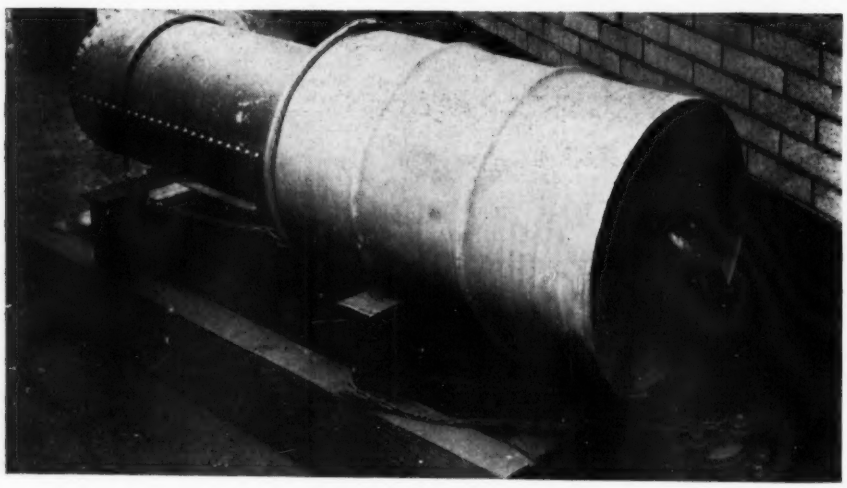


Fig. 3—Exterior view of assembled muffler.

A number of methods were considered to reduce the velocity of free discharge from the safety disk line, confine liquid and spray, and reduce the noise. The common procedure of connecting the safety disk with a tank or drain did not appear to be practical; however, it was found that increasing the transverse internal area of the discharge line in steps and attaching a muffler to the end of the line brought about the desired results. The modified system is shown schematically in Figure I.

## WATER TANK AND OIL DRUM

The muffler, illustrated in Figures II and III, is made from a piece of 4" pipe four feet long welded to a 3" x 10" nipple, a 60-gallon hot water tank and a standard 55-gallon steel drum. The 3" end of the center pipe was welded to a 90° elbow as shown in Figure II. Starting about one foot from the welded junction of the 3" and 4" pipes, a series of longitudinal slots were cut in the 4" pipe on a spiralling line extending to the open end. The slots, which are approximately 3" x ⅜" at the beginning and increase in size to 4" x 1" at the open end of the pipe were cut with a torch and left rough. An estimated 40% of the metal was removed from the three feet of pipe slotted.

A three-legged spider is welded near each end of the 4" pipe to center and they support the pipe within a concentric steel tank, 16 inches in diameter and 5 feet

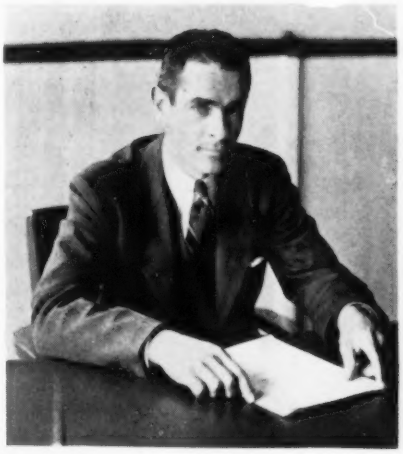
(*Turn to Page 330*)

# THE CHEMICAL PANORAMA

NEWS OF THE CHEMICAL PROCESS INDUSTRIES IN PICTURES

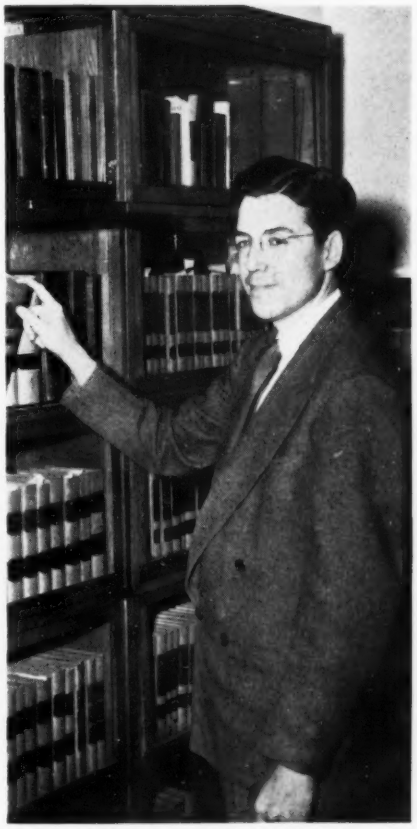
## PEOPLE

William P. Marsh, Jr., elected executive vice-president of U. S. Industrial Chemicals, Inc.



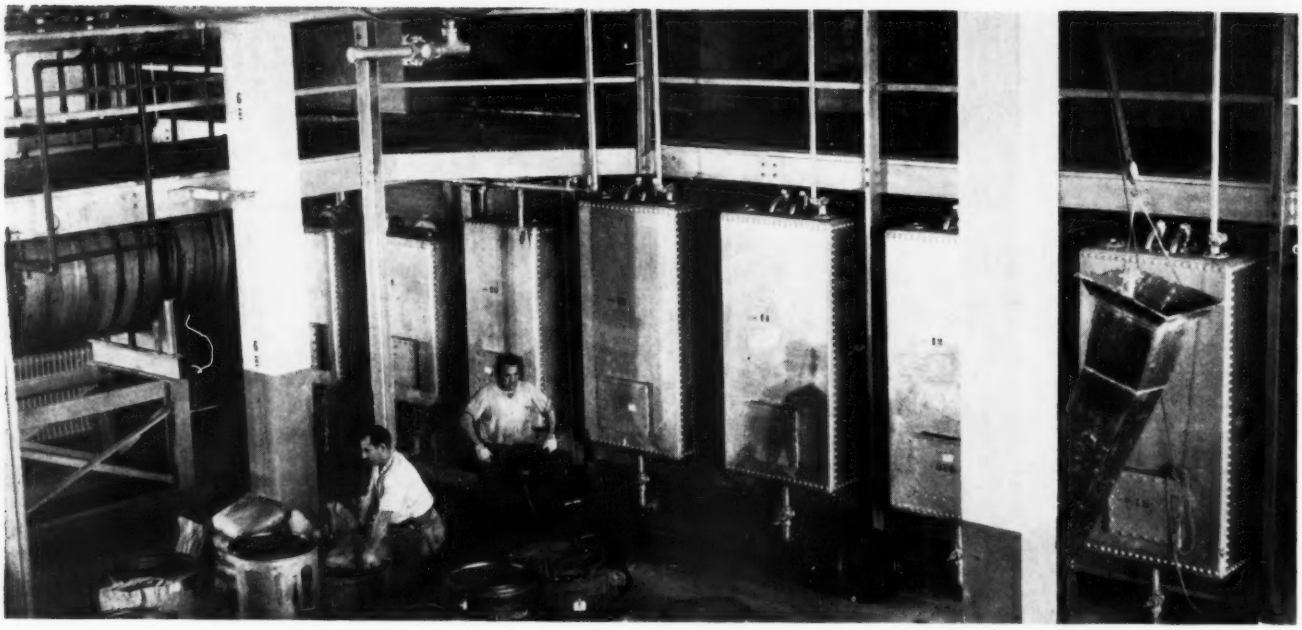
H. W. Sloan, appointed Pacific Coast manager, Multiwall Bag Div., St. Regis Paper Co.

J. W. Holmes, new sales manager in charge of commercial products, Jefferson Chemical Co.



Richard O. Zerbe, named director, Monsanto Chemical Co.'s development department, W.Va.

Crawford H. Greenwalt, elected tenth president E. I. du-Pont de Nemours & Co. He was formerly a vice-president.

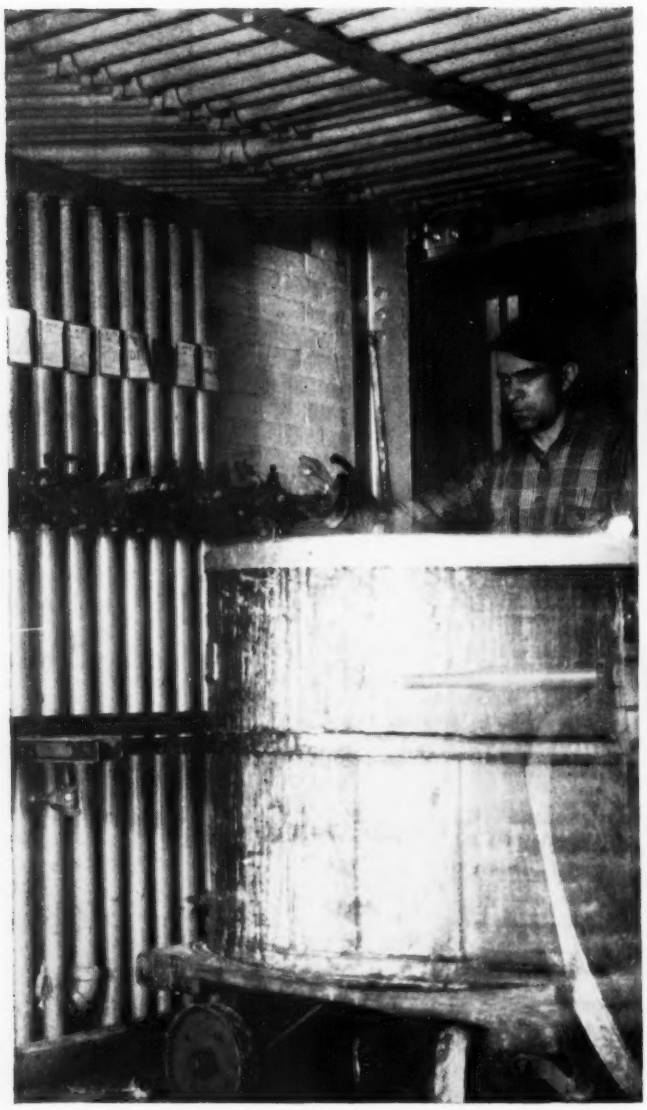


Top floor of the Stamford industrial finishes plant. The tanks in the background contain liquefied resins. At upper left are the pipes coming in from the tank farm bringing solvents to the top of the plant. From here on the flow of solvents is all taken care of by gravity.

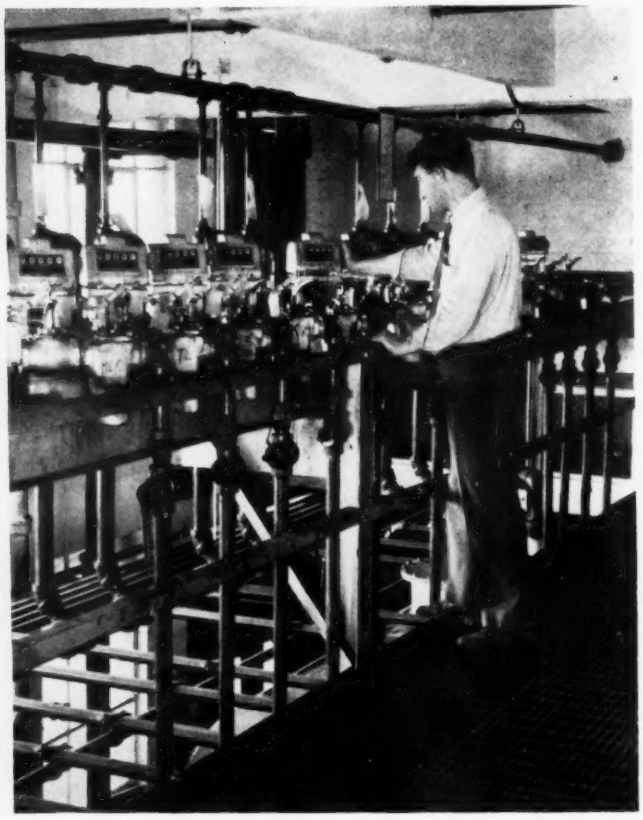
# Atlas Streamlines

Streamlining of production has greatly increased the efficiency of the Stamford industrial finishes plant, Zapon Division, Atlas Powder Co. New machinery, new methods are being used, and the unit has been expanded. This expansion has been completed without any interruption of operations.

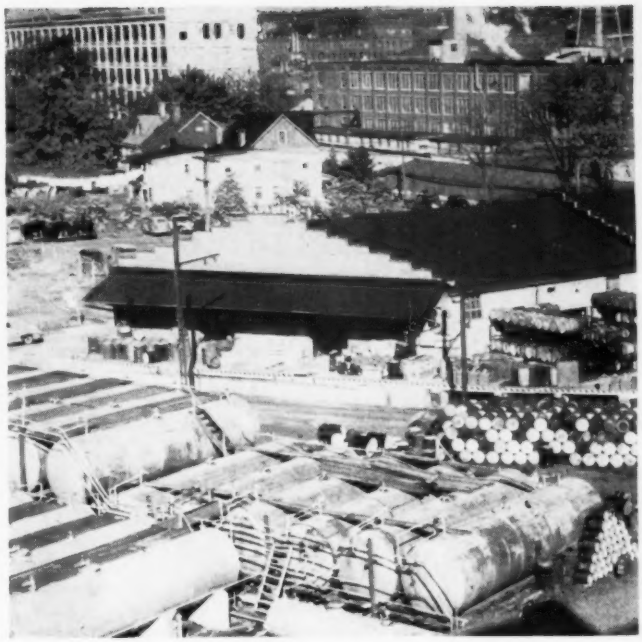
Among the innovations is a system for piping solvents and liquefied resins to the point of operation, instead of carting them in drums. The resins are mixed in tanks at the top of



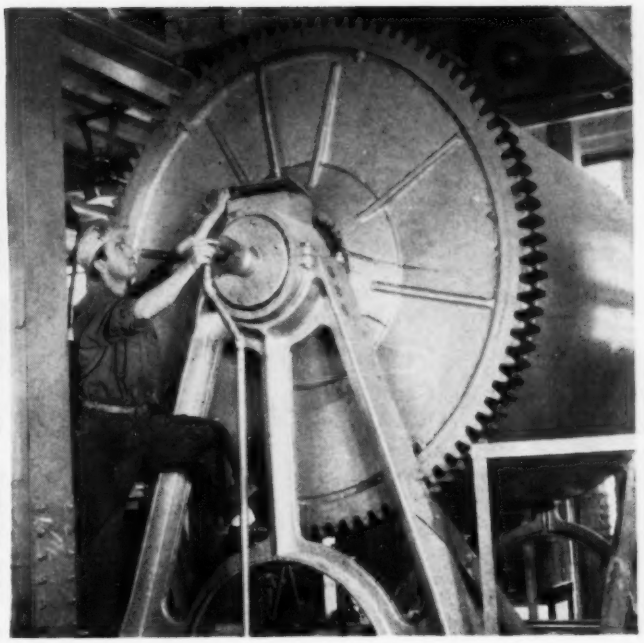
Solvents and resins mixed in tanks on the top floor flow into pipes near the points of operation, avoiding the use of unwieldy drums.



Meters on the top floor provide a means of checking just how much solvent is being pumped up from the tank farm, ready to be mixed.



The tank farm and warehouse where drums of resins and pigments are placed on fork-type lifting machines which can move pallet loads easily.



The mainshaft of a Berylite ball mill is checked for grease. Inside thousands of stones about the size of turkey eggs grind the pigment

# Paint Production

the building, the solvents are mixed outside and pumped to the top floor. The force of gravity takes care of the rest. Thus the main ingredients are on tap all the time. It's a straightline system that both simplifies the operation and speeds it up.

In addition, all material in the warehouse is stored on pallets, wooden platforms about five feet square. Fork-type lifting machines move these pallet loads wherever they are needed, and the pallets save space in the warehouse.

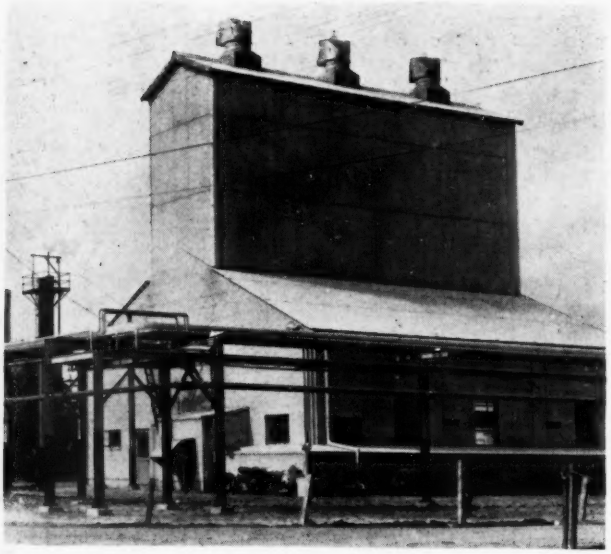
One of the roll mills which disperse the pigments in the solvents and other ingredients. It is fed by 28 solvent, 11 resin pipes.

Finished products are poured in drums for shipment. The finishes are run through a cloth at the top of the drum to remove lumps

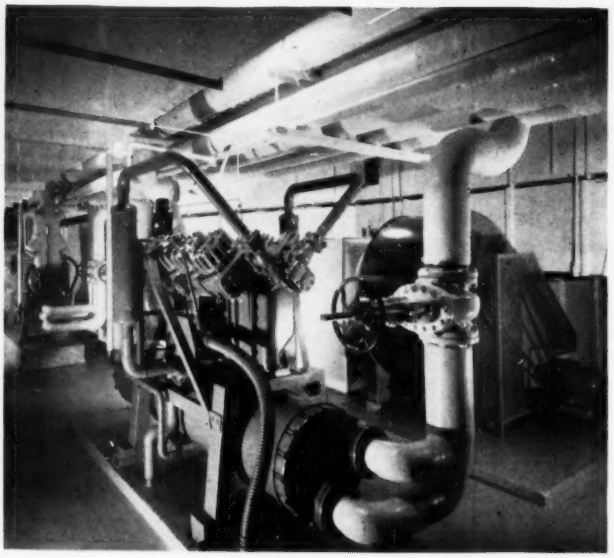
The three story limestone entrance to the laboratory conceals its evaporative cooling tower which serves the building's air-conditioning.

# Shell's New Laboratory

The new Exploration and Production Research Laboratory of Shell Oil Co. at Houston, Texas, combines several unique features. Special installations for uniform control of light, temperature, humidity and sound have been designed to meet the exacting requirements of geophysical research. All air is distributed through a double-duct air-conditioning system to maintain humidity at specified levels, and also passed through electrostatic precipitators which remove dust particles.



The Plenum chamber extends alongside the building, is used to preheat replacement air, necessary when outside temperatures are low.



These two refrigerating compressors are located in the third floor penthouse with all other central service equipment, thus leaving the lower floors free for functional activities of the working staff.

The machine shop, designed to turn out special precision equipment as required, extends across the end of one wing on the ground floor.

The glass blowing department, overlooking the courtyard. Glazed ceramic tile lines the walls as it does in all the laboratory rooms.

The manufacture of pharmaceuticals has advanced rapidly, and with the development of such drugs as penicillin, the industry has contributed much to the progress of medical science. In the manufacture of penicillin, Victor* Phosphoric Acid plays a vital role in the recovery of the raw product from the harvest liquor. Victor Phosphorus Oxychloride serves as a chlorinating agent in the processing of sulfa drugs. Phosphorus Oxychloride is also employed in one of the steps in the synthesis of atabrin, the anti-malarial specific.

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# NEW PRODUCTS & PROCESSES

### *Vinyl-Vinylidene Chloride Copolymers* NP 605

Three new members of the Geon 200 series resins have recently been made available by B. F. Goodrich Chemical Co. The 200 series, made up of modified polymers of vinyl chloride, has included to date Geon Resins 202 and 203, which have been standard items of production for several years. Now Geon Resins 204 and 205 are in commercial production, with Geon Resin 200X14 available in experimental quantities. These new materials offer increased thermoplasticity and lowering of softening point plus greater solubility. Injection or compression molding materials require thermoplasticity coupled with good flow properties at processing temperatures. Geon Resins 204, 205 and 200X14 were developed to offer improved properties in this regard.

Good solubility, another characteristic possessed by these resins makes them highly useful in the solution coating field.

These new resins are more thermoplastic and, therefore, process at much lower temperatures than 202 or 203. As a result, this new series can be processed and molded into rigid articles with little or no plasticizer. Improved thermoplasticity more than compensates for the lower heat stability of the new materials since high processing temperatures are not necessary.

Geon 205 has been designed as a rigid molding material requiring no plasticizer. The development of this material has been so directed that it is particularly well adapted for use in the molding of phonograph records. Records molded from Geon 205 possess an extremely low noise level, high fidelity in reproduction, outstanding wearability and high resistance to breakage.

Another interesting application is in the molding of rigid sheeting of the type used in playing cards and advertising novelties. The manufacture of battery separators, industrial lacings, rigid piping or heat-sealable name tapes are other possibilities.

### *Sulphonated Fatty Esters* NP 606

A new series of sulphonated fatty esters from vegetable sources is being marketed by E. F. Drew & Company, Inc. The materials are known as Sulphonated Estols.

A combination of oil refining, distillation, hydrogenation and chemical processing makes available sulphonation products free from mineral oil, resinous substances, or proteinaceous and pectic impurities.

Sulphonated Estols have excellent color and odor properties and are exceptionally free from development of odor and color upon aging.

The increased yield of high quality sulphonated esters from vegetable oils makes these new products available at prices lower than conventional sulphonated oils or sulphonated tallow. They are available in several grades with properties corresponding to various sulphonated natural oils and sulphonated tallow.

### *Germination Indicator* NP 607

Arapahoe Chemicals, Inc., can now supply 2,3,5-triphenyltetrazolium chloride in immediate quantities for research studies. This reagent provides a simple, quick, and reliable test for the ability of seeds to germinate.

Triphenyltetrazolium chloride stains the embryo of a wide variety of seeds without staining the remainder of the seed. It is so sensitive that it is possible to distinguish the essential parts of the embryo—epithelium, plumule, and primary root—and to make certain the prediction of viability of the seed.

Although many agricultural schools in this country and abroad have conducted successful studies with this staining reagent, this is the first commercial offering of triphenyltetrazolium chloride. Production is still at the research stage, but will be developed as rapidly as possible.

### *Protective Coatings for Construction Materials* NP 608

Sika Chemical Corp. has developed a protective coating known as Sika Seal. It is claimed to have excellent adhesion to wet or dry surfaces. Application of

the paint under water is shown and discussed in a new pamphlet issued by the company.

Sika Seal is not an emulsion. Tests listed in the pamphlet describe the protection Sika Seal gives to concrete, mortar, wood, steel or other metal or nonmetal surfaces.

### *Polymethacrylic Acid Textile Size* NP 609

Polymethacrylic acid (PMA) textile size is now available from the du Pont Co. It is particularly suited for slasher sizing raw nylon continuous filament warps.

PMA is readily water soluble, easy to apply and is easily removed in scouring. Since this new product has excel-


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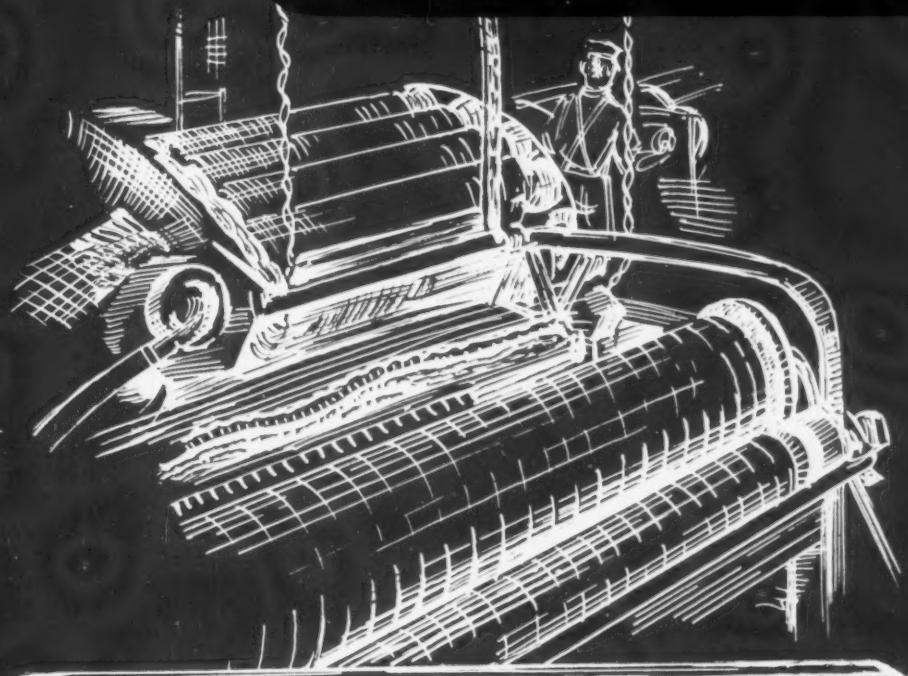

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**The versatility of Ansul Liquid Sulfur Dioxide in industrial practices is illustrated by the following examples:**

**ACIDITY** . . . . . $SO_2 + H_2O \rightarrow H_2SO_3$

**ANTICHLOR** . . . . . $SO_2 + 2H_2O + Cl_2 \rightarrow H_2SO_4 + 2HCl$

**ANTI-OXIDANT** . . . $SO_2 + Na_2O_2 \rightarrow Na_2SO_4$

**HYDROSULFITES** . . . $2SO_2 + Zn \rightarrow ZnS_2O_4$

**SULFOXYLATES** . . . . $2SO_2 + 2Zn + 2CH_2O + H_2O \rightarrow (CH_2O \cdot HSO_2)_2\,Zn + ZnO$

**NEUTRALIZATION** . . $2SO_2 + 2NaOH \rightarrow 2NaHSO_3 \rightarrow Na_2S_2O_5 + H_2O$

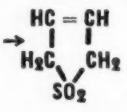
**SULFURYL CHLORIDE** . $SO_2 + Cl_2 \rightarrow SO_2Cl_2$

**SULFITES** . . . . . $SO_2 + H_2O + 2NH_3 \rightarrow (NH_4)_2\,SO_3$

$SO_2 + CaCO_3 + H_2O \rightarrow CaSO_3 + CO_2 + H_2O$

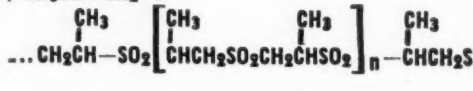
$SO_2 + Ca(OH)_2 \rightarrow CaSO_3 + H_2O$

**THIOSULFATES** . . . . $SO_2 + S + 2(NH_3) + H_2O \rightarrow (NH_4)_2S_2O_3$

**SULFONES** . . . . . $SO_2 + CH_2{=}CHCH{=}CH_2 \rightarrow$ 

**GOLD RECOVERY** . . . $3SO_2 + (Au \cdot 2HCl \cdot 2HNO_3)\ (\text{aqua regia}) + 2H_2O \rightarrow Au + 2HCl + 3H_2SO_4 + 2NO$

**CHROME TANNING** . . $3SO_2 + Na_2Cr_2O_7 \cdot 2H_2O \rightarrow 2Cr(OH)SO_4 + Na_2SO_4 + H_2O$

**PLASTICS** . . . . . $SO_2 + CH_3CH{=}CH_2 \rightarrow$ 

**In addition Ansul Liquid Sulfur Dioxide is being currently used as a bleaching agent • purifier • preservative • solvent • fumigant • protective atmosphere in magnesium fabrication • refrigerant and in polymerization, etc.**

**Consult Ansul Technical Staff relative to the development of these and other applications for $SO_2$ in your processes.**

**Write for treatise on Liquid Sulfur Dioxide and request bulletins describing the specific application in which you are interested.**

LIQUID Sulfur Dioxide BY ANSUL*

## PHYSICAL PROPERTIES

| | |
|---|---|
| Chemical formula | $SO_2$ |
| Molecular weight | 64.06 |
| Color (gas and liquid) | Colorless |
| Odor | Characteristic, pungent |
| Melting point | −103.9° F. (−75.5° C.) |
| Boiling point | 14.0° F. (−10.0° C.) |
| Density of liquid at 80° F. | (85.03 lbs. per cu. ft.) |
| Specific gravity at 80° F. | 1.363 |
| Density of gas at 0° C. and 760 mm. | 2.9267 grams per liter (0.1827 lb. per cu. ft.) |
| Critical temperature | 314.82° F. (157.12° C.) |
| Critical pressure | 1141.5 lbs. per sq. in. abs. |
| Solubility | Soluble in water |
| Purity | 99.9+% (by wt.) $SO_2$ ($H_2O$ less than 0.01%) |

*REG. U.S. PAT. OFF.

*For your* METHYL CHLORIDE *applications . . . . Use* ANSUL METHYL CHLORIDE

**ANSUL CHEMICAL COMPANY**
INDUSTRIAL CHEMICALS DIVISION, MARINETTE, WIS.
60 E. 42nd St., New York — 535 Chestnut St., Philadelphia


lent adhesion to raw nylon, loom shedding (the flaking or powdering of the size) is practically eliminated when PMA is applied to the warp uniformly and in proper amounts. These warps generally exhibit a satisfactory break at the split rods. With normal pick-up of size and proper drying on the cans, the split should occur well before the warp reaches the first bar.

For scouring, conventional hot water, soap, and alkaline scours have been found satisfactory in removing PMA from woven fabrics. Yarn which has been tinted may require special scouring procedure. Packaged as a dry powder, PMA size is available in 50 and 100 pound, net, containers.

### *Emulsifier for Toxaphene* NP 610

Normally a waxy, semi-solid material, the new Hercules insecticide Toxaphene can now be solubilized by means of a special emulsifier, Trex 45, developed by Griffin Chemical Co.

Fifty per cent concentrations of Toxaphene with 50 per cent Trex 45 require only moderate agitation after addition of water for immediate field use. The emulsions provided are stable and can be handled easily with ordinary spray equipment. Trex 45 will also emulsify solutions of Toxaphene in kerosene.

### *Protective Coating for Metals* NP 611

A strippable plastic coating developed by Maas & Waldstein Company is known as Copeel. It was developed to provide an envelope-type protective coating for use over bare metals and finished products to protect them from rust, corrosion, marring and scratching while in transit or in storage. Water-resistant, Copeel is available for hot or cold application and can be removed from the article simply by piercing its surface and then peeling.

### *Adhesives for Silicone Rubber* NP 612

A new adhesive expressly designed for bonding silicone rubber to itself and to glass, metals, and ceramics has been developed by the General Electric Chemical Department.

Known as G-E adhesive #12509, the new type bonding agent, possessing properties similar to silicone rubber, remains flexible and resilient over temperatures ranging from —70° F. to 520° F. and withstands continuous temperatures of 300 to 350° F. in a dry-air circulating oven. It can also be used to bond glass to glass, glass to metals, and metals to metals.

The new adhesive has proved especially

# Formaldehyde

HEYDEN

**DESCRIPTION: Formaldehyde Solution U.S.P.; Formaldehyde content: not less than 37 per cent by weight.**

**APPEARANCE: Clear, colorless liquid; Low acid, ash, and metal content.**

**Formaldehyde *Heyden* is rigorously controlled to assure consistent yields and high quality of finished products. Technical data on the use and handling of formaldehyde are available upon your request.**

***Dependability is assured when you specify* HEYDEN**

**FORMALDEHYDE · PARAFORMALDEHYDE · HEXAMETHYLENETETRAMINE**

**Formaldehyde Solution is available in Tank Cars, Tank Trucks,* Drums, Barrels, Kegs, Carboys, and Bottles.**
***New York metropolitan area only.**

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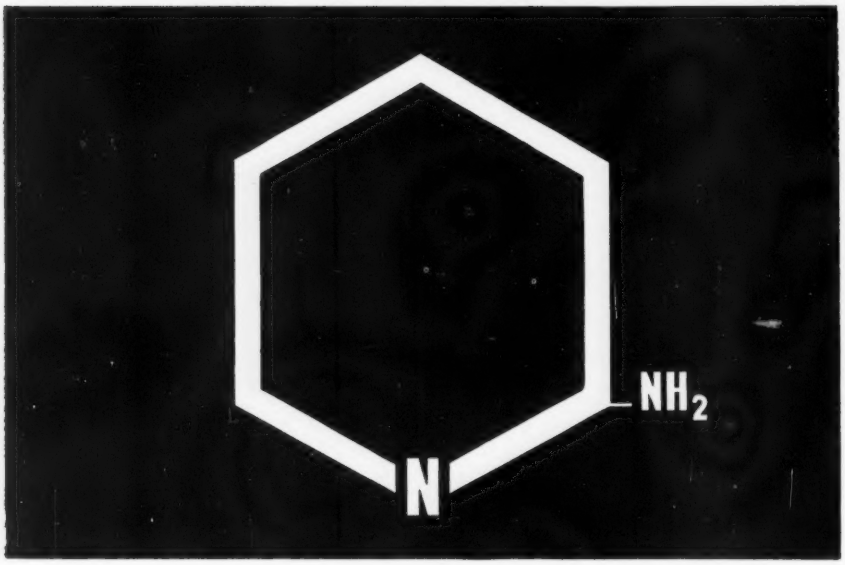
**393 Seventh Ave., New York 1, N. Y.**
CHICAGO OFFICE, 20 North Wacker Drive
PHILADELPHIA OFFICE, 1700 Walnut Street

# Reilly

# 2-Aminopyridine




**AN ORGANIC CHEMICAL**
**OF CONSTANTLY INCREASING IMPORTANCE**

One of the most interesting coal tar materials developed by Reilly during the past several years is 2-AMINOPYRIDINE, which is today recognized as an organic chemical of constantly increasing importance.

The use of 2-AMINOPYRIDINE in the manufacture of sulfapyridine is well known. Its more recent utilization in the manufacture of medicinals for alleviation of the distress of various allergies is important. A striking recent discovery is its ability to prevent the decay of citrus fruits.

In contrast to Pyridine, 2-AMINOPYRIDINE is readily sulfonated, nitrated, halogenated, mercurated or similarly processed, and is a unique starting material for the synthesis of pyridine compounds.

Reilly COAL TAR PRODUCTS

**Other Reilly Aminopyridines include:**
**2-Amino-3-Methylpyridine, 2-Amino-4-Methylpyridine, 2-Amino-5-Methylpyridine, and 2-Amino-6-Methylpyridine. All of these materials are available in 95% purity.**

**REILLY TAR & CHEMICAL CORPORATION**
MERCHANTS BANK BUILDING, INDIANAPOLIS 4, INDIANA
**500 Fifth Ave., New York 18, N. Y. • 2513 S. Damen Ave., Chicago 8, Ill.**

*Reilly Coal Tar Chemicals For Industry*


useful in securing silicone rubber door gaskets directly to oven doors, eliminating the need for clamps and bolts. It is also effective for joining the ends of extruded cured stock to form O-ring gaskets of uniform thickness. Previously these gaskets had to be made by molding the loose ends of uncured stock together in a press, causing one portion of the ring to be smaller than the rest.

### *N-Bromosuccinimide* NP 613

A new substance which excels as a brominating agent where it is desired to substitute bromine for an active hydrogen without adding bromine to an unsaturated linkage is N-bromosuccinimide.

This product which is white to pale buff in color, has a faint bromine odor and occurs in fine crystalline powder. Molecular weight is 178.0, active bromine is 44.2 per cent and the melting point is 174°-178° C.

The general method of bromination consists of heating molecular proportions of N-bromosuccinimide and the substance to be brominated in carbon tetrachloride. The succinimide produced by the reaction separates on the surface of the solution from which it can be removed by filtration. In some cases catalysis by benzoyl peroxide of ultraviolet radiation is advantageous. Friedel-Crafts catalysts promote aromatic substitution.

Samples will be furnished upon request to the manufacturer—Arapahoe Chemicals, Inc. Fifty-lb. drums are sold at $5.00 per lb.

### *Swedish Tall Pitch* NP 614

Large tonnages of a high-grade tall-oil pitch, a product of the newest and largest tall-oil plant in Sweden, are now available for export. The material has the appearance of a low-grade rosin. The melting point is 110° F., and the acid number is 138.2 (Wijs). The product can be landed in New York for less than 4c per lb. It is offered by MoDo Corporation, Stockholm, whose U. S. and Canadian agent is Gaston Johnston Co.

### *Inhibitor for Acids* NP 615

Inhibitor No. 9 is a liquid inhibitor that dissolves readily in acid solutions. Showing inhibiting action in both hydrochloric and sulphuric acid solutions, this product is important where exhaust ventilation is not available. In these solutions the inhibiting action is over 90 per cent and in some cases ranges up to 98 per cent.

The inhibitor, which is practically odorless, dissolves cleanly in the acid solution leaving no sludge or residue. Acid solutions, therefore, are easily rinsed off the work.

It is available from Enthone, Inc., as

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FINE CHEMICALS

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In Wisconsin: General Chemical Company, Inc., Milwaukee, Wis.

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SETTING THE PACE IN CHEMICAL PURITY SINCE 1882

* Complete stocks are carried here.

# WE'VE DONE IT FOR ADHESIVE MANUFACTURERS

THERE was a time when adhesives, such as mucilage, paste and glue, had anything to recommend them but a pleasant odor. But not today. Refinement of raw materials, improved processing *and* the ingenuity of technical perfumers have wrought a change. Now these adhesives —or most of them—have either no odor, or if any, it is one agreeable to the human nose. By extension of this odor-masking principle, improvement in gummed tapes, laminated and other glue-impregnated products has also been achieved. . . . Now, the question is: Have *you* such a problem to solve?

# PERHAPS WE CAN DO IT FOR YOU!

In the course of your manufacturing or processing operations there may arise certain odor conditions detrimental to the efficiency or comfort of your employees . . . or your finished product may retain some residual odor that acts as a deterrent to sales. In either case we may be able to help you remove or lessen the cause. We'll try if you will write us fully . . . in confidence, of course . . . and with no obligation on your part.

**FRITZSCHE** *Established* 1871 **Brothers, Inc.**

**PORT AUTHORITY BUILDING, 76 NINTH AVENUE, NEW YORK 11, N. Y.**

BRANCH OFFICES *and* *STOCKS: *Atlanta, Ga., *Boston, Mass., *Chicago, Ill., Cincinnati, Ohio, Cleveland, Ohio; Dallas, Texas, Detroit, Mich., *Los Angeles, Calif., Philadelphia, Pa., San Francisco, Calif., *St. Louis, Mo., *Toronto, Canada and *Mexico, D. F. FACTORIES: Clifton, N. J. and Seillans (Var), France.


a liquid which dissolves very readily in the pickling solution. The inhibitor is suitable for use in both cold and hot pickles. Steel coated with scale, oxide, and rust can be quickly pickled without attack upon the base metal. Therefore, bright surfaces are left bright after pickling operations, the result being an improved product when simple pickling is done, or a better base for plating or hot coating.

Suggested procedure is one pint or one pound of Inhibitor #9 in each 25 gallons of pickling solution. Inhibitor #9 is strongly absorbed and should not be used in pickles prior to plating without using the following sequence of operations: (1) After pickling, rinse thoroughly in running cold water; (2) soak in hot water for about 5 minutes; (3) rinse in running cold water; (4) anodic clean in Cleaner #100 for one minute; (5) rinse in running cold water; (6) dip in 10 per cent by volume sulphuric acid; (7) rinse in running cold water; (8) plate. Cost is approximately 50c per pound when purchased in small quantities.

### *Peelable Coating* NP 616

Peelcote, a new protective coating for metal parts which can be easily and quickly peeled off after it has served its purpose, has been developed by the Watson-Standard Co.

Peelcote is an air-drying coating designed to protect from scratches, chips and corrosion during shipment, storage, handling and some types of fabrication. It can be applied by spray or dip methods and dries quickly. It is removed quickly and cleanly simply by pulling it off.

Peelcote is a vinyl-based coating with very high chemical inertness. It is available in clear transparent or solid hiding black. Additional information will be supplied on request by the manufacturer, the Watson-Standard Company.

### *Chemical Herbicides* NP 617

Two new products in the fields of agricultural and horticultural chemistry have been developed by B. F. Goodrich Chemical Co. Sodium isopropyl xanthate, and allyl mixed chlorophenyl carbonate, classified as herbicides, have been tested by federal and state agricultural experiment stations and have shown excellent results against many of the weeds and grasses not economically or satisfactorily controlled by other chemicals or practices.

Sodium isopropyl xanthate, a water soluble organic chemical, is a complete killer and cannot be applied directly to growing plants. It shows promise for preëmergence treatment in spray or dust form for the elimination of weeds from potential planting areas and has been used with success for the chemical weed-

# ULTRAPONE-S*

## A NEW *Surface Active Agent*

**DO ANY OF THESE PROPERTIES INTEREST YOU?**

- *100% Active*
- *Non-Ionic*
- *Clear, soluble in water—all proportions*
- *Active in extremely low concentrations*
- *Forms Viscous Solution in dilutions as low as 10%*
- *Nonirritating*
- *Rich Foaming*
- *Has Excellent Dispersing Properties*
- *Acid Stable*
- *Lime Stable*
- *Emollient*
- *Has Excellent Detergency*

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ULTRA Chemical WORKS

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# Complete *Your* process-picture

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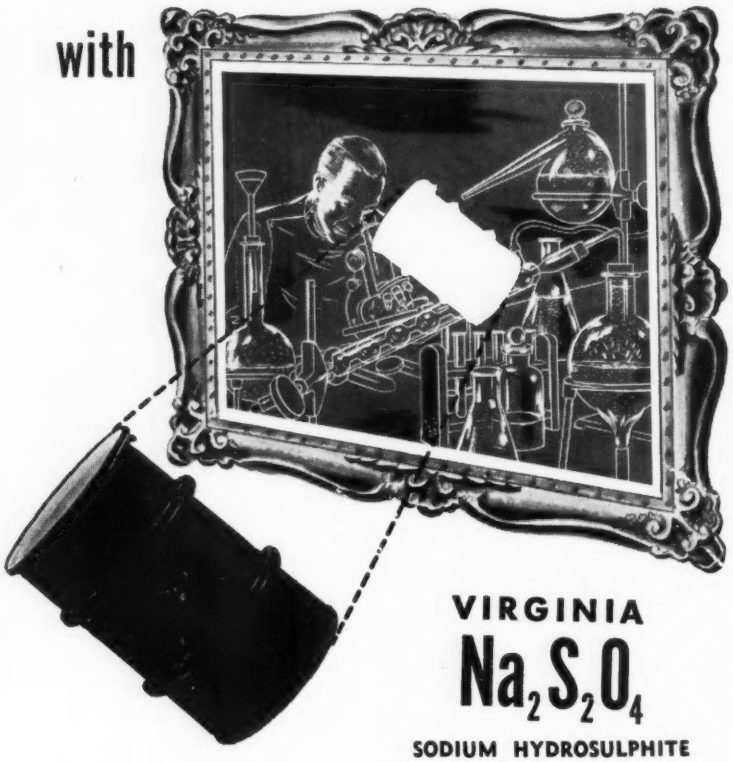


VIRGINIA

$Na_2S_2O_4$

SODIUM HYDROSULPHITE

"Virginia" Sodium Hydrosulphite is a concentrated, white, stable, free-flowing, uniformly crystalline powder, readily soluble in water. Its powerful action will reduce solutions of the salts of selenium, tellurium, arsenic, antimony, bismuth, silver, gold, copper, chromium, and mercury. It is widely used in the bleaching of soaps, sugars, oils, minerals, straw, and various fibres. Shipped in 250 lb. steel drums.

Perhaps "Virginia" $Na_2S_2O_4$ can perform some important function in improving your processes. Let us help you in adapting it . . . there's no obligation. VIRGINIA SMELTING COMPANY, West Norfolk, Virginia.

*Established 1898*

VIRGINIA *Chemicals*

SULFUR DIOXIDE
SODIUM HYDROSULPHITE • ZINC HYDROSULPHITE
ZINC SULFATE

WEST NORFOLK • NEW YORK • BOSTON • DETROIT


ing of growing crops. Tests have further proved this new chemical to be potentially useful as a vine killer, as in the case of potato plants, and a defoliant, as in cotton or nursery stocks. In addition to its usefulness as a weed killer, sodium isopropyl xanthate may be used as an eradicant fungicide for use as dormant sprays and applied to the ground during the non-growing season for aiding control of certain diseases surviving the winter on old diseased fruits or leaves.

Allyl mixed chlorophenyl carbonate differs from sodium isopropyl xanthate in that it is a selective killer, particularly useful against certain types of grasses such as crab, barnyard, orchard, blue grass, cattails and similar plants. The hormone-like action of this chemical arrests growth immediately and prevents seed development. Tests show that often no immediate effects can be observed for a week or longer, however, during this time the root structure or system of the weed has been rotting. Allyl mixed chlorophenyl carbonate will also complement the famous 2-4-D weed killer for action against some broadleaved weeds unaffected by the conventional dosage of 2-4-D. This includes the types of grasses mentioned above.

Both of these new materials are being applied in active experimental programs and are not presently available commercially.

### *Carboxymethylcellulose For Paperboard* NP 618

A new process utilizing Hercules CMC, sodium carboxymethylcellulose, gives added internal and surface strength to paperboard and added resistance to penetration of oils and waxes in paperboard. This results in higher quality gloss ink printing and a saving in ink and wax.

Hercules Powder Co.'s CMC for the paper industry is a free-flowing white, granular powder. It can be added at the calendar stack or size press and may be used separately or in conjunction with conventional surface treating materials such as starch, wax, and wax-resin emulsions.

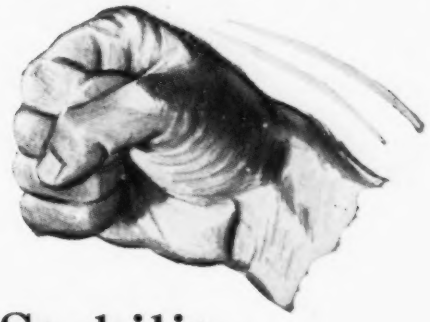
CMC's properties have found application in a wide variety of other industries including textiles, protective coatings, ceramics, rubber, printing and cosmetics.

### *Labels for Dilute Acid Bottles* NP 619

The problem of labeling bottles containing dilute solutions of acid has been solved by National Adhesives. After extensive tests the Resyn Department of that company reports that cellulose acetate paper laminated labels, after being applied with Resyn Adhesive 3045, can be submerged in a 1 per cent solution of acetic acid for several days. Even

# Two-Fisted Help!

## Sorbitol offers



New Opportunities for Manufacturing Improvements *with* Stability of –Price –Purity –Supply

Since 1935 when Atlas first offered sorbitol, its price trend has been downward, while its purity has been maintained at a high level. Used for conditioning or synthesis; sorbitol has a stabilizing effect on production costs and methods—contributing materially to stabilization of profits.

### *Stability of Price*

In the face of spiraling prices, it is refreshing to find a raw material with a history of steadily *decreasing* cost. Production know-how makes sorbitol price such that even today's inflated dollar will buy more sorbitol than a dollar would buy ten years ago.

### *Stability of Purity*

Permits uniform manufacturing operations with predictable product improvement.

### *Stability of Supply*

Dependable sources of raw material, improved techniques and expanded facilities have made possible a volume flow of sorbitol—enough for long range planning for all industry.

It's time to revise your thinking on sorbitol. Atlas has prepared a book about sorbitol characteristics and how they affect the processing of innumerable products such as cosmetics, drugs, glue compositions, chemicals, textiles, leathers and foods.

The Atlas technical staff is especially qualified to discuss sorbitol applications with you.

***In the production of synthetic resins and drying oils for paints, lacquers and varnishes, the stability factors of sorbitol as a raw material are particularly important.***

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CHARCOAL

● CHARCOAL
BRIQUETTES

●

Tennessee Products & Chemical Corp.

GENERAL OFFICE: NASHVILLE, TENNESSEE

*Eastern Sales Office:* 350 Fifth Ave., New York 1, N. Y.

when the bottles are removed from the solution, cleaned and dried, the labels remain well adhered.

Bottlers who fill liquids slightly acid in nature will find that the dripping of the solution from the pouring machines will no longer cause poor adhesion nor will the labels be stained; for the cellulose acetate face of the label offers a higher degree of resistance.

### *Wet Water Fights Fires* NP 620

A newly developed concentration of organic chemicals is of such extremely fast penetrating action that, added to water in small amounts, it increases the extinguishing action of the water 200 to 400 per cent.

The new penetrant, developed by the Carbide and Carbon Chemicals Corporation, is known as "Unox."

Normal use calls for 1 part of the penetrant to 100 parts of water, in some cases less. Although it cannot be purchased for a few cents a gallon, the cost becomes small when evaluated in terms of dollars saved through more efficient fire fighting.

Unox helps to increase the speed with which water will penetrate porous materials such as char and wood, cotton and kapok. Another characteristic of the wetting agent is its ability to spread and creep over a surface. Tests using water to protect metal surfaces, such as storage tanks, from radiated heat indicate that when a wetting agent is present in the water, the cooling efficiency is increased by as much as 50 per cent.

A report of a test of the new penetrant by the U. S. Forest Service in Virginia indicated that on mop-up operations where a solution of ½ per cent was used, an average of ½ gallon of solution per stump was required for complete extinguishment, with no rekindling. When plain water was used, an average of 1¼ gallons was used per stump, with 95 per cent rekindle.

### *Unique Plastic Process*

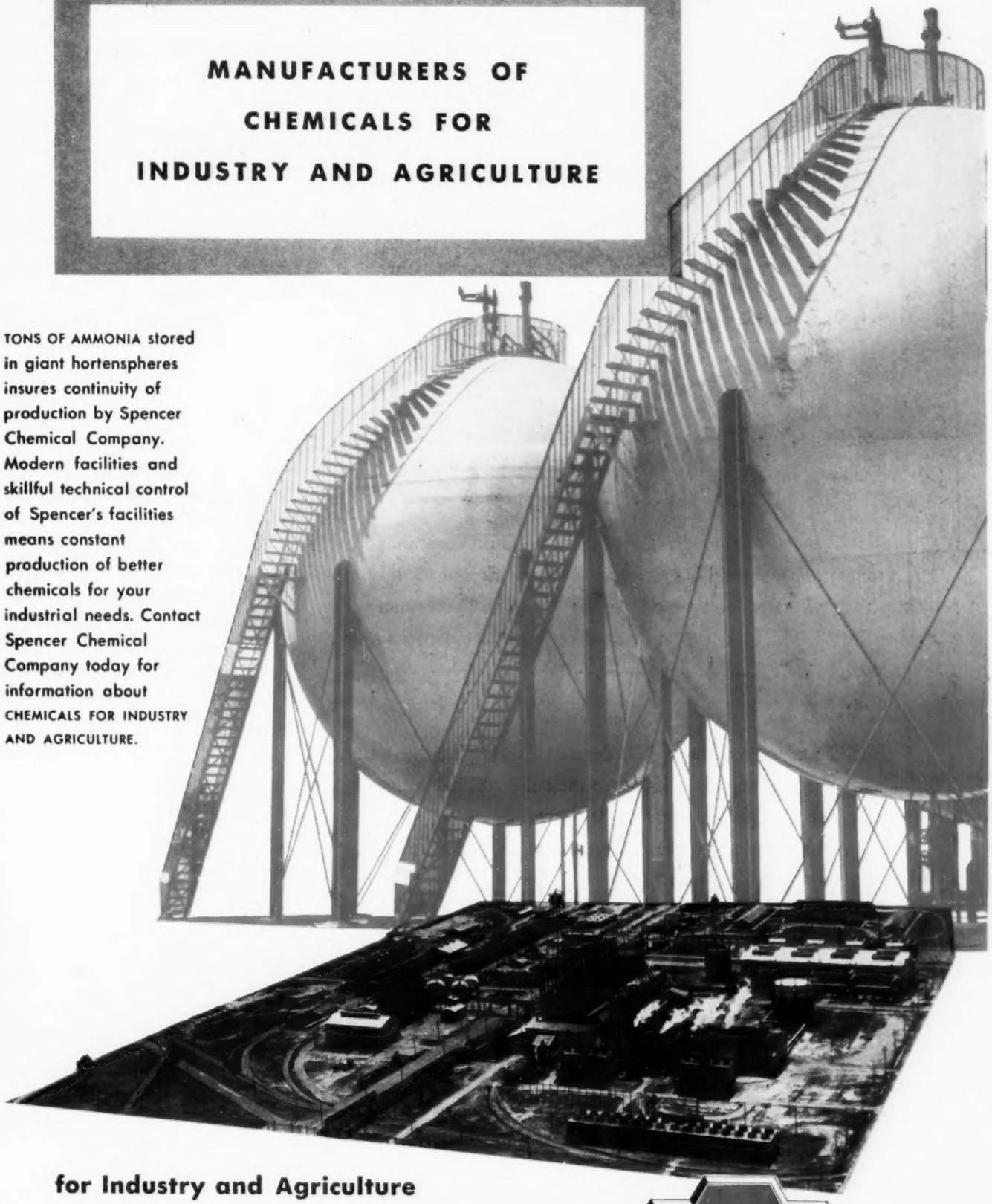
A new method for the manufacture of plastic which is based on the action of microorganisms yields Castwood. It was developed and is now in commercial operation in Scotland.

Such diverse materials as metals, wood waste, coffee grounds, dead leaves, ashes, plaster of Paris and silica crystals can be used as filler to make this tough, strong substance.

The process consists of preparing a culture of specific airborne spores. These are infected with another fungus culture, and then another. At a certain point development is arrested and in the dormant phase the organisms can be stored or shipped.

When they have been mixed with the

# MANUFACTURERS OF CHEMICALS FOR INDUSTRY AND AGRICULTURE



TONS OF AMMONIA stored in giant hortenspheres insures continuity of production by Spencer Chemical Company. Modern facilities and skillful technical control of Spencer's facilities means constant production of better chemicals for your industrial needs. Contact Spencer Chemical Company today for information about CHEMICALS FOR INDUSTRY AND AGRICULTURE.

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SPENCER

**SPENCER CHEMICAL COMPANY**

Executive and Sales Offices, 5B Dwight Bldg., Kansas City 6, Mo.
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# SULPHUR THROUGH A PIPE

*Molten Sulphur is sprayed into a storage vat at the Grande Ecaille property of Freeport Sulphur Company in Louisiana.*

*One of a series of Stories of Sulphur*

SULPHUR is mined through a pipe. On the Gulf Coast Sulphur is mined not as a solid but as liquid; not by pick and shovel but by superheated water. Sulphur men use water and pipes and air pressure for tools and learn from instruments about the deposits they never see.

HEATED under pressure to 320 degrees Fahrenheit, the water is piped down hundreds of feet to melt the Sulphur in its underground deposit. Molten streams of yellow mineral are forced to the surface, and still glowing are poured into the storage vat to cool and harden.

THOUSANDS of feet of pipe carry the compressed air, water and molten Sulphur and millions of gallons of water are used in the process. Great power plants keep pumps, compressors and boilers operating and sensitive instruments record temperature and pressure.

## FREEPORT SULPHUR COMPANY

**OFFICES: 122 East 42nd Street, New York 17, N. Y.**

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**SULPHUR SERVES INDUSTRY**


filler to be used they can be activated by the addition of water and in some cases a nutrient of woodflour. Their whole activity is a ceaseless ingestion of food. It appears that the micro organisms exude or excrete a kind of "cement" which not only binds the plastic material but also makes it heavy. When copper filings are used as filler the substance produced is more than one third the weight of a disc of copper of corresponding size.

The strength of this plastic is shown in the following example: The modulus of rupture in any direction for an average material composed of woody matter is 3260 lbs. per square inch.

### *Vitamin Esters for Food Enrichment*

A cheaper and more dependable method of enriching margarine with Vitamin A has come out of the research and technical division of Wilson & Co.

Until now, deterioration of Vitamin A in margarine during storage has been so rapid that manufacturers have had to add a 20 per cent surplus of the vitamin to offset unavoidable losses. Margarine fortified by the new method will retain its Vitamin A content much longer, so that manufacturers will be able to reduce substantially the initial amount of the vitamin.

A series of experiments indicated that Vitamin A in the form of distilled esters is consistently more stable over a long period than Vitamin A in the alcohol form hitherto employed.

### *Technique for Testing Air-Cooling Designs*

Striving continually to economize on space and weight, engineers devote much of their effort to a quest for smaller radiators to absorb the roaring heat of the modern aviation engine. A new and simple technique for testing designs utilizes models of radiators cast in naphthalene.

Air blown over the naphthalene causes it to evaporate, and by noting the rate of evaporation at different points on the model, engineers can estimate accurately the cooling efficiency of the design.

The new method requires fabrication of simple plaster of paris molds in place of metal parts, and all the necessary measurements can be made with a micrometer, whereas determination of heat absorption by metallic models demands elaborate equipment.

Actually, rates of mass transfer are measured, but these can be converted to rates of heat transfer.

Air-cooling plays an important role in air-conditioning, refrigeration, and other commercial processes. This technique was developed at the Cornell University School of Chemical and Metallurgical Engineering.

# THE RAT MARKET ...and your sales opportunity with ANTU

There is one rat for nearly every man, woman and child in the United States—an estimated 137,000,000 rats.

Rats cost this country an appalling sum every year—about $400,000,000—as estimated by one Government Service.

They compete with man for food, carry diseases transmissible to him, destroy or undermine his buildings, cut his electrical insulation, damage his property.

Rats are the most harmful, the most destructive, the most menacing to human health, of all the animal pests.

Today with such an effective and efficient rat-killer available as ANTU—a tremendous opportunity for sales is open to you.

**THE CHEMICAL**—ANTU (alpha-naphthyl-thiourea), discovered by government-sponsored research during the war, is a highly specific poison for the brown (Norway) rat—*the rat most commonly found in cities, towns, and on farms in the U. S.* It is relatively non-poisonous to other rodents and animals. So far as is known, it is non-toxic to man except in large amounts.

**ITS PROPERTIES**—ANTU is a finely granulated gray powder. It is insoluble in water but soluble in some organic solvents including ethyl alcohol, acetic acid, dioxan and pyridine. It is chemically stable, non-volatile, and non-irritating to the human skin.

**EASE OF MIXING**—ANTU mixes evenly with all kinds of food (or ground grain) and adheres well to dry or wet foods when dusted on them. It sticks to the feet and hair of rats when they run through it. It dusts well from insect dust sprayers and pump guns.

**HOW IT WORKS**—ANTU kills through the stomach, not through contact with the skin. Rats die when they eat it in their food or lick it off their feet and hair—usually within 10 to 24 hours.

**ITS APPLICATION**—ANTU is a single-shot poison. Its success depends on the rat's getting a fatal dose at the first meal, since they quickly develop a tolerance which lasts about 30 days and an aversion which may last longer.

The J. T. Baker Chemical Co. is now ready to supply you ANTU for manufacturing purposes. Write today for prices.

Our descriptive bulletin gives latest information and recommendations on ANTU—how to use it—precautions to take. Send for it! Address *Agricultural Chemical Division*. J. T. Baker Chemical Co., 66 South Main Street, Phillipsburg, N. J.

## THE COSTLY RAT!

### RATS WASTE FEED

"About 50 pounds of grain or its equivalent are required to maintain one rat for 1 year, representing a minimum annual cost of 50 cents per rat for food actually consumed," says a Government Service. In addition, rats waste and contaminate about 100 pounds for every 50 pounds they eat.

### RATS KILL CHICKS

Rats often kill apparently purely for the lust of killing. They have been known to kill several hundred baby chicks in a single night. Even full-grown hens and ducks, baby pigs, and lambs are killed. Large quantities of eggs are commonly destroyed.

### RATS DAMAGE PROPERTY

Rat damage to property includes holes gnawed in many articles, including grain bags, leather, expensive upholstery, fabrics, furniture, doors, books, and even lead pipes—flooding, caused by burrowing in embankments—fires, caused by gnawing and short-circuiting electric wires—and undermining foundations of buildings.

### RATS RUIN FOOD

To get at food rats usually gnaw through the container and ruin the whole package, although only a little is eaten. In warehouses, feed stores and mills, sacks of grain, stock feeds and flour are often spilled and fouled. In wholesale and retail grocery stores they gnaw into breakfast foods, crackers, bread, candies and almost all food products in cardboard, paper or wooden cartons.

### RATS SPREAD DISEASE

Rats not only carry bacteria and other parasites on their feet and bodies, they transmit diseases of their own to man and domestic animals. Also, they acquire a number of human and livestock diseases, contributing to their spread. Diseases spread by rats include bubonic plague, typhus fever, spirochetal jaundice, rat-bite fever, food poisoning, tularemia, rabies, trichinosis.

### HALF OF RATS ON FARMS

Government authorities estimate half of the rats in the United States are on farms . . . about 26 per cent are in non-farm country residences and in towns of less than ten thousand population . . . about 24 per cent are in cities of ten thousand or more. On the basis of observations by many people engaged in rat control, they roughly estimate there is one rat per person in the U. S.—about 137,000,000 rats.

### LOSSES RUN INTO MILLIONS

A careful survey by one of the members of a Government Service last year resulted in the estimate of an annual loss of approximately $200,000,000 worth of cereals and cereal products as a result of foods eaten or damaged by rats. Total estimates of all damage range between $300,000,000 and $500,000,000 per year.

**"If everyone understood the true status of the rat, how dangerous and how destructive a rodent it is, not a single rat would be allowed to exist in or near an abode or place of business."**
—*U. S. A. Wildlife Circular 6.*

**Baker's Chemicals**

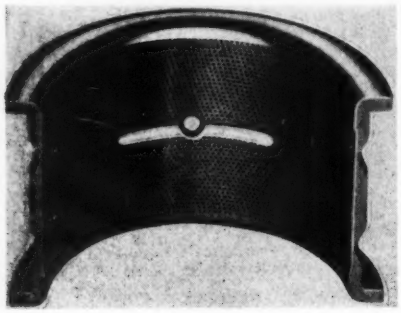
C. P. ANALYZED • FINE • INDUSTRIAL

# NEW EQUIPMENT

### *Gridded Bearings* QB 425

Gridded bearings are a new product of the National Bearing Division of the American Brake Shoe Co.

According to the manufacturer, babbits have previously been known as the best bearing material within their strength limit. Babbitt's strong points are con-



formability, embedability and seizure resistance. However, babbits fail when stressed or pounded too heavily. Stronger materials, such as copper-lead steel back bearings, have been developed but they require harder shafts, more and cleaner lubricant and greater constructional accuracy.

When steel tubing became available, the centrifugally cast lead-tin bronze bearing became available. Its casting technique produced solidification in one direction only, eliminating the usual center weakness caused by the solidification of each wall towards the center. With a 0.002" lead-tin coating in the bore this bearing has given good service but increasing loads brought a demand for even better bearings.

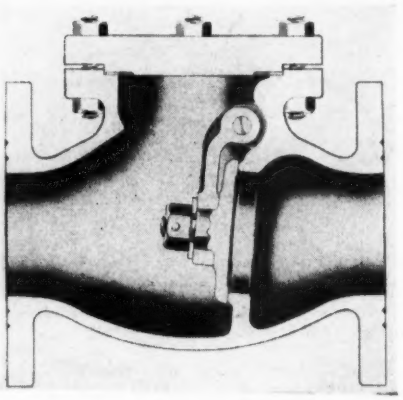
Gridding the centrifugally cast lead-tin bearing was the step taken by National Bearing to handle these increasing loads. The result is reported to be a bearing which has good conformability, embedability, and a gridded bearing which is self-healing.

These bearings are now operated under loads of over 3500 psi projected area with shafts of 160 Brinell hardness. The minimum depth of the grids is 0.008" and the minimum area of the babbit is 40%. They are customarily in half bushings but full cylindrical bushings can be furnished.

### *Corrosion Resistant Swing Check Valves* QB 426

Crane Co. has introduced new lines of corrosion-resistant swing-check valves. These valves, made in both 18-8 Mo alloy steel and Monel metal, are available in sizes ½"-2" with screwed or flanged ends, and in sizes 2½", 3", 4" and 6" with flanged ends only.

In the sizes ½- to 2-inch, the body is made in a Y-pattern, and the cap is on



the same center line as the seat opening. The large cap-opening gives access to the internal parts when the cap is removed, so that seating surfaces can be reground without taking the valve body from the line. A slot in the end of the disc spud permits rotating the disc with a screwdriver.

In the 2½", 3", 4" and 6" sizes, the body is the straightway type shown in the illustration, with the seat face at only a slight angle from vertical, permitting full straightway flow. In these sizes the cap is bolted to the body. The seat in these valves is cast as part of the body, and the face is accurately machined to assure pressure-tight seating of the disc.

When so ordered, the 2½"-6" valves can be furnished with outside lever and weight, which can be applied either to assist the disc in closing, making the valve extremely sensitive to reversal of flow, or to balance the disc, causing the valve to open under a minimum of pressure.

These new checks are designed for the moderate pressures and temperatures usually encountered in piping corrosive fluids. The valves are recommended for liquid or gas working pressures up to 150 psi and for a maximum temperature of 350° F.

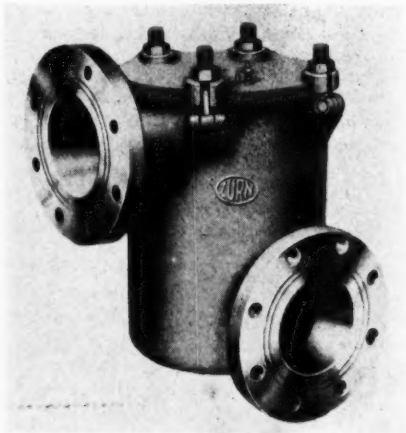
### *Plastic Tubing* QB 427

The Irvington Varnish & Insulator Co. has introduced a line of flexible tubings, complete in all sizes up to 3" in diameter, for industrial and laboratory needs.

Tubings are available in a complete range of colors, as well as in clear plastic, and in standard and special formulations for any particular requirement. Specially formulated tubings are designed for high-pressure and high-temperature needs, for service requiring unusual acid, alkali and chemical resistance, and for applications where odorless, tasteless and non-toxic are required.

### *Offset Strainer* QB 428

An offset sinlex strainer has been developed by J. A. Zurn Mfg. Co. to permit the strainer to be completely drained as




the line itself is drained. With the inlet and outlet at right angles, the unit can be installed to form a right angle connection in a piping system.

The basket and basket chamber can be made any length, depending upon the amount of entrainment in the stream. The cover is removable for lifting out the perforated strainer basket, and a cleanout plug is furnished to permit steam blowdown cleaning when practical.

[redacted]

**CHEMICAL INDUSTRIES, 522 Fifth Ave., New York 18, N. Y. (2-8)**

Please send me more detailed information on the following new equipment:

| | | | | | |
|---|---|---|---|---|---|
| QB 425 | QB 429 | QB 433 | QB 437 | QB 441 | QB 445 |
| QB 426 | QB 430 | QB 434 | QB 438 | QB 442 | QB 446 |
| QB 427 | QB 431 | QB 435 | QB 439 | QB 443 | QB 447 |
| QB 428 | QB 432 | QB 436 | QB 440 | QB 444 | QB 448 |

Name ..... Position .....
*(Please Print)*

Company .....

Street .....

City ..... Zone ..... State .....

BEMIS MINUTE MOVIES

# FOR SHIPPERS WHO WANT TO SAVE TIME AND MONEY

★ ★ ★

# CEDRIC, THE CHEMICAL THAT WALKED IN HIS SLEEP

1. Cedric is a strange chemical . . . has the jitters . . . is hard to control.

2. Formerly he sifted about in storage . . . went sleep-walking and wasted his strength.

3. He needed better packaging . . . got it in a Bemis Waterproof Bag. Now he sleeps like a baby through long days and nights in storage.

4. And Cedric's rarin' to go when it's time for work.

Some chemicals sift out of ordinary containers and cause additional loss by damaging products nearby. They need the protection of Bemis Waterproof Laminated Textile Bags. These bags are extra sturdy . . . they resist tears and punctures. They are fully tested *before* they're put to work. *These pre-tests stop protests* . . . assure complete satisfaction.

Guard your products during shipment and keep them safe in storage with Bemis Waterproof Bags. Mail coupon now for prices and complete information.

## BEMIS BRO. BAG CO.

Waterproof Department

Nation-wide Production and Sales

BEMIS Waterproof BAGS

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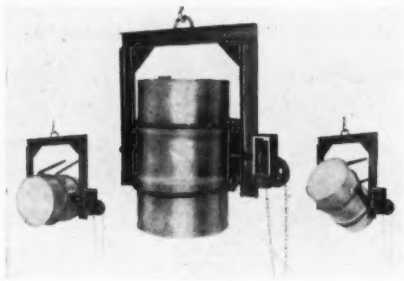
408-J Pine Street, St. Louis 2, Missouri
Send details about Bemis Waterproof Bags for
*Name* _____
*Company* _____ *(Product)* _____
*Street* _____
*City* _____ *Zone* _____ *State* _____

The strainer is made in cast bronze, steel, semi-steel, or iron, or alloyed metals for corrosion resistance. Types are available for working pressures from 125 to 300 psi. in sizes from 1½" to 12" flanged, screwed, or welding connections.

### *Drum and Barrel Tilt* QB 429

A new drum and barrel tilt of the Palmer-Shile Co. completely eliminates hand dumping. The unit illustrated is 1000 lb. capacity for standard 55 gallon



drum or barrel. Special sizes or capacities can be built. It is equipped with two safety style locking devices that hold barrel securely without slippage. Barrel can be turned 360 degrees. The turning mechanism incorporates the worm drive principle and is available in hand chain models.

### *Spring Check Valve* QB 430

The new spring check valve, series 1000, of the Pokorney Mfg. Co. is for use on air compressors, gas pumps, etc. Piston operated and spring-loaded, this new valve is reported to operate with a minimum of noise and provide a positive non-leaking check to water, air, oil, or gas.

The Series 1000 valves are cast from high grade bronze and, after precision machining, each is individually tested. They are now available in ⅛", ¼", ⅜", ½" and ¾" I.P.S. screwed ends. Larger sizes will be available soon.

### *Nitrogen Generator* QB 431

Gas Atmospheres, Inc., has developed a new nitrogen generator, the "Hi-Nitrogen Generator". This self-contained generator is a combustion method unit for producing nitrogen at a cost of a few cents per 1000 cubic feet of dry gas. The equipment operates on a mixture of air and natural gas or any manufactured gas such as butane, propane, water gas or coke oven gas.

### *Continuous Viscosity Recorder for High Viscosity Fluids* QB 432

The new Viscorator of the Fischer and Por-Ter Co. will continuously measure the viscosity of flowing fluids with viscosities as high as 800,000 centipoises.

In this new unit the measuring elements are a precision-bore glass tube surrounding a long cylindrical plunger-like float equipped with a weighted extension. This is contained in a chamber above the main part of the instrument.

Fluid moving up past the plunger exerts viscous drag, the amount of displacement of the plunger providing a measure of the viscosity. Recording and controlling instruments are available.

### *New Platform Scale Features Improved Pivots* QB 433

The new Load King dormant platform scale of the Yale and Towne Mfg. Co. was developed to eliminate excessive wear on the main pivots, such as that caused by dropping heavy loads on the scale from overhead cranes and the lateral movement caused by driving loaded trucks onto the scale.

The main pivots are protected by a new outboard, corner support bearing construction. Damage to the main fulcrum pivots is prevented by means of corner load links and auxiliary fulcrum pivots. According to the manufacturer, the new construction prolongs scale accuracy and excessive wear on the pivots is eliminated.

### *In-Line Filter with Porous Stainless Steel Elements* QB 434

In-line filters fitted with porous stainless steel filter elements are now available from the Micro-Metallic Corp. All passageways are readily cleaned and all elements are readily replaceable with ele-

PATTERSON-KELLEY
Heat Transfer EQUIPMENT
Stainless Steel
AS WE MAKE USE OF IT
★ KETTLES
★ HEAT EXCHANGERS
★ COOLERS
★ AUTOCLAVES
★ COOKERS
★ CONDENSERS
We have two experiences to offer in connection with your requirements along the above lines: (1) many years of experience in the design and construction of many types of heat transfer equipment; and (2) many years of experience in working with the stainless steels as used for such equipment.
Our engineers will be glad to work out the proper design of equipment to meet your requirements or help your engineering staff in any way if you prefer to do your own designing.
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NEW YORK 17—101 Park Ave.
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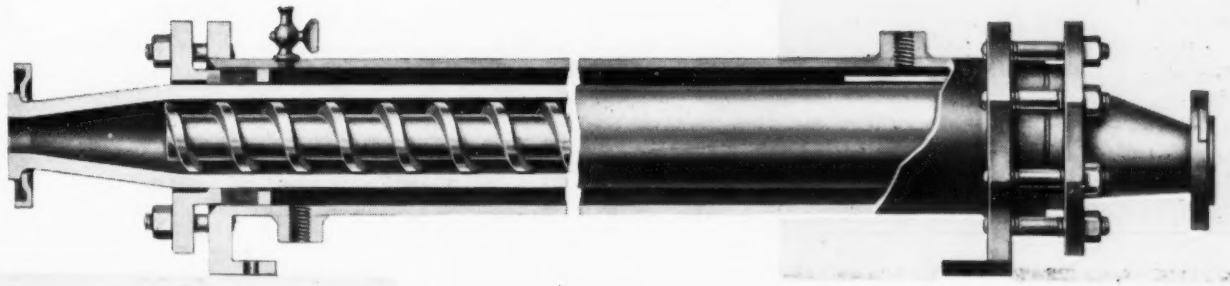
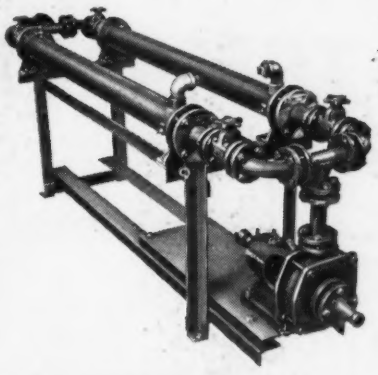
BOSTON 16—96-A Huntington Ave.
Representatives in Principal Cities

# 6 advantages of this NEW DURCO CORROSION-RESISTING HEAT EXCHANGER for the Chemical Industry

1. MADE OF DURIRON, the high silicon iron that closely matches the broad corrosion resistance of non metallic materials. It retains excellent resistance to the common corrosives at all concentrations and temperatures.
2. NO DILUTION of solution.
3. EXCEPTIONALLY HIGH K VALUES obtained by a unique design that fully utilizes the pressure drop to break down the fluid film.
4. COMPLETE FLEXIBILITY OF INSTALLATION. Can be installed horizontally or vertically, near the ceiling, on the next floor, or in the next room. Supplied in banks supported on a single frame, if desired.
5. NO PACKING AGAINST THE CORROSIVE SOLUTION.
6. REPAIRS (if any) made without emptying solution tanks or shutting down.





Standard Durco units are available with one to nine or more heat exchangers in banks — together with the necessary corrosion-resistant valves, pipe, fittings and pump — supported by one frame. Prints showing typical layouts will be sent on request. Ask for Folder T.

Now available for the first time — a heat exchanger that is applicable to the many heat exchange problems in chemical process plants. The *new** Durco No. 4 and No. 8 heat exchangers provide a *high* temperature rise or drop in *one* pass. The small size of the units permits flexibility of arrangement. They can be set up in series or parallel — or both — to handle from 5 GPM to 100 GPM with temperature changes of 300° F. Examples:

1. Cooling 20 GPM of 70% $H_2SO_4$ from 360° F. to 150° F., with 80° F. water, requires 24 8C coolers, four parallel banks of six units each in series.

2. Cooling 14 GPM $H_2SO_4$-hydrocarbon mixture from 235° F. to 95° F., using 20° C. water, requires 10 4C coolers in two parallel banks of five units each in series.

3. One Duriron 4C cooler will cool 15 GPM bleach solution from 80° F. to 65° F. with cooling water at 45° F.

Write for Bulletin 1603.

*Not to be confused with the thousands of Duriron No. 6 and No. 12 heat exchangers in service, the primary application of which was to maintain a fixed temperature of a volume of solution where the rate of recirculation and temperature rise was of secondary importance.

DURCO Adv. 51-GM

DURCO
CORROSION RESISTING
ALLOYS & EQUIPMENT

**THE DURIRON CO., INC.**
DAYTON 1, OHIO
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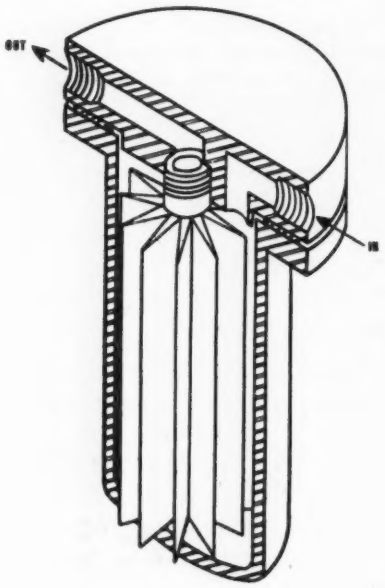
ments of a different porosity. Filter bodies are normally supplied for 200 psi service.

Three principal types of elements are supplied: cylindrical, bayonet and star



type. The cylindrical elements are not normally recommended for high pressure differentials, bayonet elements being normally utilized for this type of service. Star type elements are provided for the larger installations.

Units are available with filter areas ranging from 18 square inches to 24 square feet. Pore openings of the elements range from 20-65 microns.

### *CO Tester* QB 435

A new product of the Mine Safety Appliances Co. is the M.S.A. carbon monoxide tester.

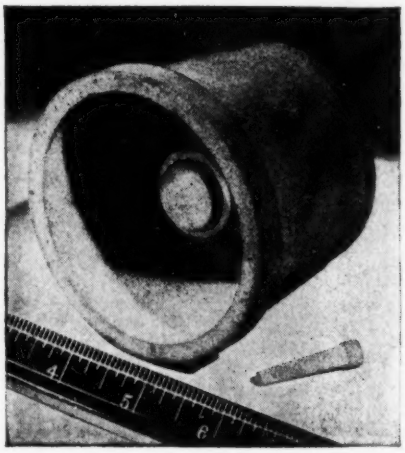
The tester will indicate carbon monoxide concentrations from 0.001-0.10% by volume in air. The detector tube contains a yellow silica gel, impregnated with a complex silico-molybdate compound and catalyzed by means of palladium sulfate and in use, the sealed ends of the tube are broken in a tube-breaker and the tube inserted into the instrument tube-holder. A sample of the air is aspirated through the tube by squeezing the bulb of the instrument.

If the sample contains carbon monoxide when it is drawn through the tube, the yellow indicating chemical turns varying shades of green, directly proportional to the CO concentration; the degree of discoloration of the gel is then compared with the instrument's integral revolving color scale for quick and easy reading.

### *Porous Metal Filters and Diffusers* QB 436

A virtual metal sponge available in a wide range of porosity for the filtering of liquids or to control the flow of liquids and gases, made in many different shapes to meet particular applications, is available from Henry L. Crowley & Co., Inc.

This latest Crowley powder-metallurgy product is available in various metals or alloys to withstand corrosion. It can be fabricated into discs or flat plates, cylin-



ders, truncated cones, plugs or inserts, and other shapes meeting mechanical considerations. Sizes range from tiny plugs or inserts fitting into fuel lines of internal-combustion engines, to large filter units as shown in the accompanying illustration.

The mechanical strength of such a bulky screen, its long-wearing properties, the maintenance of precise porosity if kept clean or clear of sediment, the ease with which it may be applied because it is shaped to fit in place, makes this Crowley screen material ideal for many applications. However, inasmuch as each application presents its own peculiar requirements, the material is fabricated only to special order.


HYGRASCOPIC MATERIALS
OILY MATERIALS
POWDERED MATERIALS
PIGMENTS

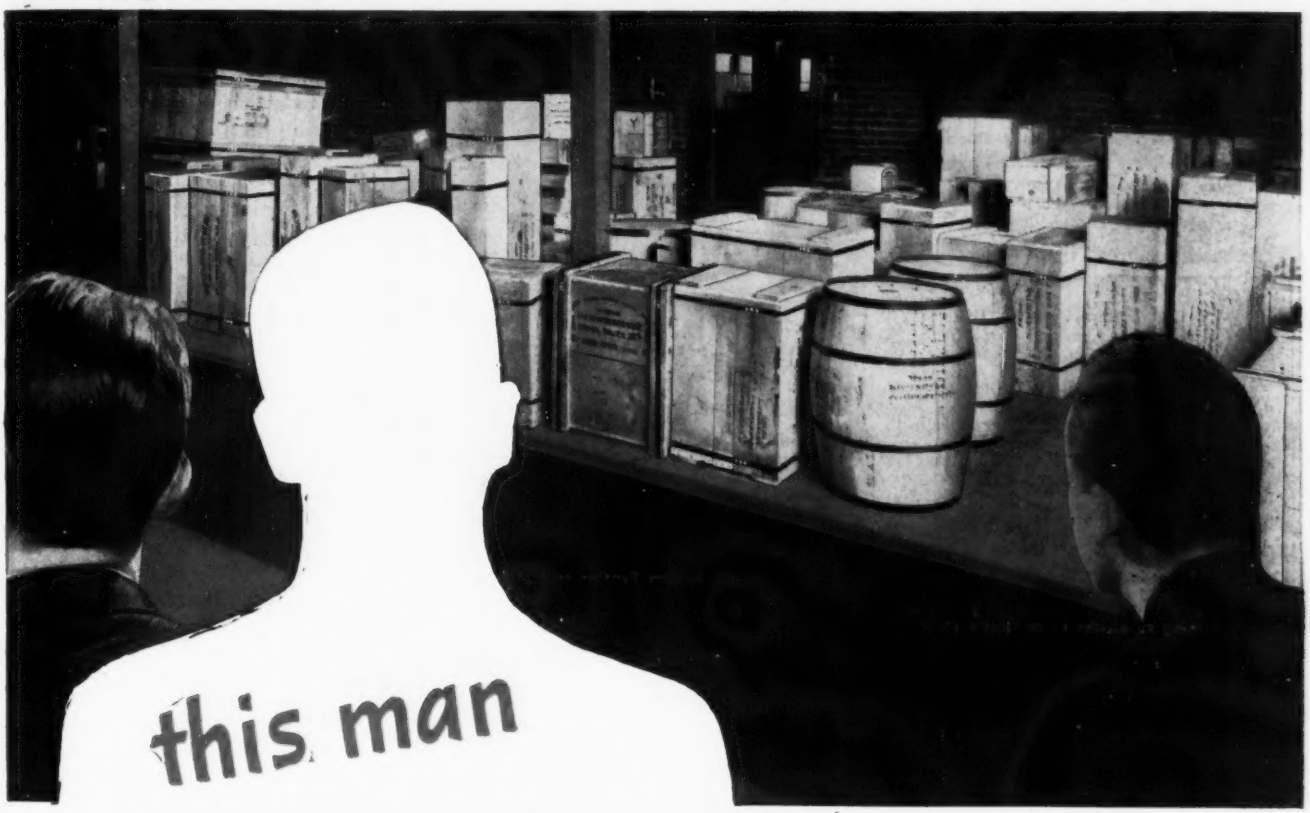
..IT'S *All* IN THE BAG!

WHEN YOU USE
SIFT-PROOF, MOISTURE PROOF
*Fulton* WATERPROOF BAGS

FULTON WATERPROOF BAGS are tough, but light. They reduce handling and shipping costs, allow larger volume of product per pound of shipping weight. FULTON WATERPROOF BAGS are economical, safe, easily packed and stored. FULTON Artcraft printing displays your name and brand to advantage—a plus advertising value.

FULTON BAG & COTTON MILLS
*Manufacturers Since 1870*
ATLANTA ST. LOUIS NEW YORK NEW ORLEANS WINTER HAVEN, FLA.
MINNEAPOLIS DALLAS KANSAS CITY, KANS. DENVER PHOENIX, ARIZ.

# Shipments travel safer after...



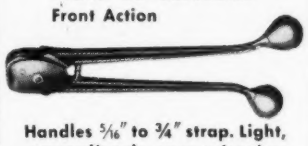

## applies SIGNODE'S SIX-POINT SYSTEM!

Are customers complaining about damaged shipments? Shipping costs mounting day by day? Consult a recognized packaging and shipping authority . . . a SIGNODE engineer . . . and learn the solution to your problems.

The SIGNODE engineer—guided by the *Six-Point System of Planned Protection*—goes at once to the heart of your problem. Training, skill and broad experience enable him to recommend an effective solution.

Regardless of the kind of products you ship, how you ship them, or where they are consigned, you owe it to your customers—and to yourself—to learn about this modern shipping protection. Take action *now!* Mail coupon.

**NEW SE SEALERS**
**Front Action**



Handles 5/16" to 3/4" strap. Light, streamlined, easy crimping effort.

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1. On-the-job survey of your shipping problems
2. Test-proved recommendation of right strapping
3. Test-proved recommendation of proper strapping tools
4. Recommendation of the right seal
5. Fast tool replacement and repair service
6. Supplementary bulletin service to keep you abreast of developments in better shipping and packing methods

**SIGNODE MEANS STEEL STRAPPING**

**SIGNODE STEEL STRAPPING COMPANY**
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STEEL STRAPPING SIGNODE PROTECTS
**SIGNODE**®
YOUR SHIPMENT SIGNODE AGAINST DAMAGE

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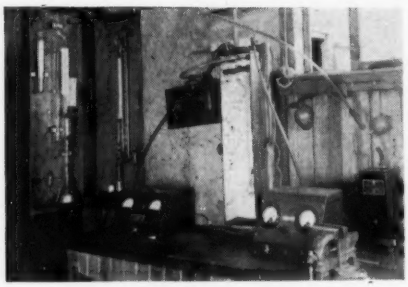
We want to know how *Signode's Six-Point System of Planned Protection* can improve our packing and shipping methods.

Have Signode engineer call ☐
We ship.....in Cartons ☐ Crates ☐ Boxes ☐
Bags ☐ Bales ☐ Bundles ☐ in Carloads ☐ LCL ☐

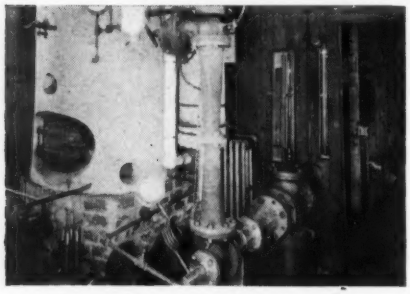
Name.....
Address.....
City.....Zone.....State.....

# What's Behind a CR Evactor?

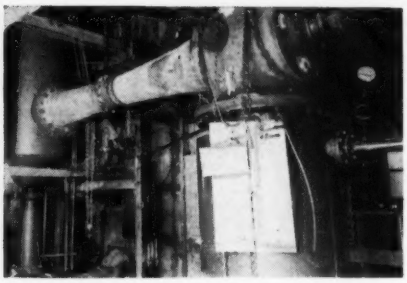
The production of Evactors is no routine operation at the Croll-Reynolds plant. Although CR engineers have over thirty years of industrial vacuum experience to guide them, the Croll-Reynolds testing and development department is one of the important units of the company. Development work is constantly under way to improve the efficiency of Croll-Reynolds Evactors wherever it is possible. It is this never-ending research and development which give CR Evactors their exceptional efficiency.



1. Instruments in the CR laboratory set up for measuring extremely high vacuum.



2. Special boiler in the CR pilot plant for providing unusual conditions of high pressure steam or superheat (or both) to duplicate the working conditions in customers plants.



3. A 30-inch CR Booster Evactor on test in a CR shop.

**CROLL-REYNOLDS CO.**

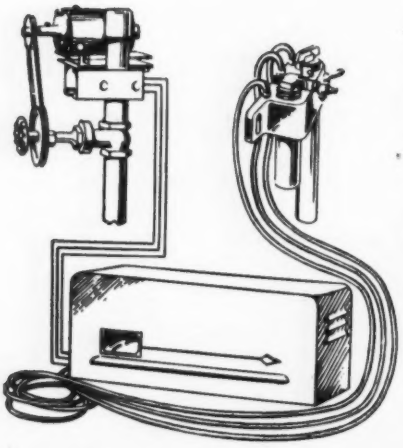
17 JOHN STREET, NEW YORK 7, N. Y.

CHILL VACTORS STEAM JET EVACTORS CONDENSING EQUIPMENT

CROLL-REYNOLDS

# AUTOMATIC
## *Pulp Density*
# CONTROLLER

### Visual Control by Motor Regulation of Dilutant



This apparatus eliminates both the frequent checking of classifier density and manual regulation of water by the attendant. Water dilution is regulated to maintain percentage of solids within close limits of any predetermined point. Thus, size of finished product is also controlled. Results in maximum efficiency in classification and grinding at optimum capacity.

Available with standard chart recorder or arm and weight for HEAVY MEDIA separation. Location widely optional. Many applications in nonmetallic and chemical plants, including potash and phosphate plants, coal washing, etc.

When writing, please state your problem.

DENVER
SALT LAKE CITY
EL PASO
NEW YORK CITY

The Mine & Smelter Supply Co.

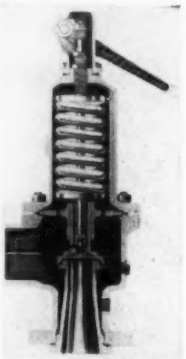
CANADIAN VICKERS, LTD. MONTREAL
W. R. JUDSON SANTIAGO, LIMA


According to the manufacturer, the improved design permits chemical reactions and separation of coagulated solids in a fraction of the time necessary in intermittent cold process softeners. The retention time depends upon the characteristics of the raw water and the purpose for which the treated water is to be used, but usually is in the order of 60 to 70 minutes as compared to four hours or more with conventional systems.

### *Safety-Relief Valve* QB 437

Farris Engineering Corp. has developed a new type of safety-relief valve for handling corrosive materials at inlet pressures up to 2000 psi., and temperatures up to 900° F.

The new valve, Type #2680, is made of cast steel with stainless steel trim. A high disc lift permits full capacity discharge. The nozzle body is of long neck construction to permit proper nozzle flow without restriction. Body is fully ribbed



to absorb piping stresses. A stainless steel baffle plate restricts flow of vapors into spring chamber. An alignment spool, hardened steel threaded into the disc, holds both disc and stem in perfect alignment with each other and the guide cylinder, preventing leakage and seeping. 2½ to 1 guide ratio of the disc guide assures full lift and positive reseating.

The long, low-stressed, protected loading spring maintains accurate set pressure. A modification of this valve has all working parts of the valve isolated behind a vapor-proof "Farriseal" curtain of rubber, "Neoprene" or any flexible metal, designed to withstand the action of specific acids or caustics. An additional modification consists of steam coils internally mounted to maintain fluid temperature for very viscous materials.

New valve is available in sizes from 1½" x 2" to 6" x 8". Parts of valve are completely interchangeable.

### *Power Driver* QB 438

In less than twenty seconds, the Mine Safety Appliances Co. Model "B" velocity power driver anchors pipe hangers and conduit boxes to structural plate or concrete. Threaded or headed studs, driven instantaneously, perform these and scores of formerly time-consuming tasks in a matter of seconds.

# Smoothness in flow control.... POWELL VALVES

**Fig. 1708**—200-pound Bronze Globe Valve with screwed ends, union bonnet, renewable, specially heat treated stainless steel seat and regrindable, renewable, wear-resisting "Powellium" nickel-bronze disc.

Like the smooth performance of a birch canoe paddled by an expert on the still waters of a lake—that's the way a Powell Valve operates. For into every valve engineered by Powell go the skills accumulated through more than a century of making valves—and valves only.

Perfection of design, scientific selection of materials, finishing to exacting specifications—all contribute to smooth, dependable performance that insures longer life and reduces maintenance to a minimum.

So when you need valves—either for new installations or for replacements—remember there's a "smooth" Powell Valve for every flow control service in modern industry.

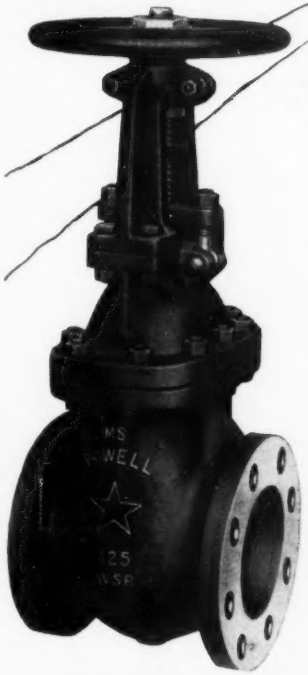


**Fig. 1793**—Large 125-pound Iron Body Bronze Mounted Gate Valve. Made in sizes 2" to 30", incl. Has outside screw rising stem, bolted flanged yoke and taper wedge solid disc. Also available in All Iron.

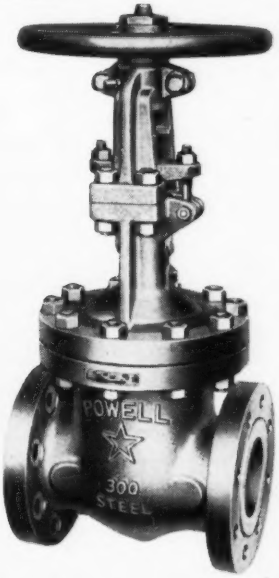



**Fig. 3003**—Class 300-pound Cast Steel Gate Valve with flanged ends, bolted flanged yoke, outside screw rising stem and taper wedge solid disc.

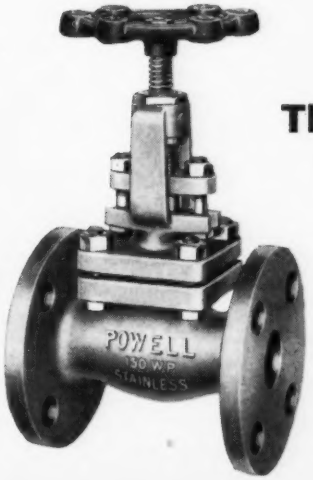


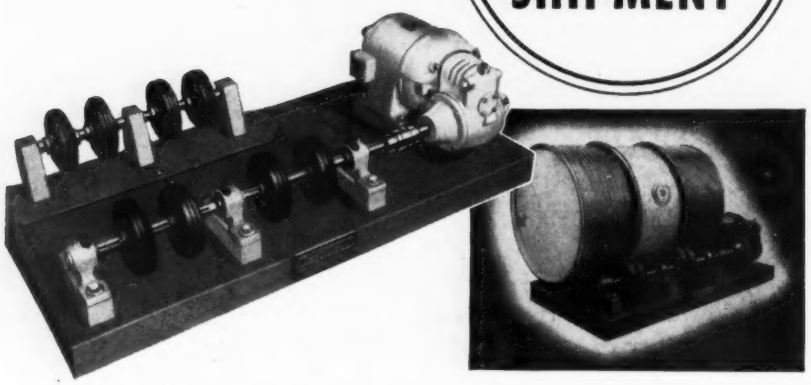

**Fig. 1979**—150-pound Stainless Steel Globe Valve with flanged ends, bolted flanged yoke-bonnet and outside screw stem.

**The Wm. Powell Co.**
**Cincinnati 22, Ohio**
**DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES**

# POWELL VALVES

# "U.S." DRUM MIXING EQUIPMENT

*Available* FOR PROMPT SHIPMENT



***Yes,*** we can once again make prompt shipment of "U. S." Drum Rollers and Drum Tumblers. We have received a few of the still critically short special motors we require. So, if you would like to take advantage of this faster, better, more economical way of mixing liquids or powders, write us today.

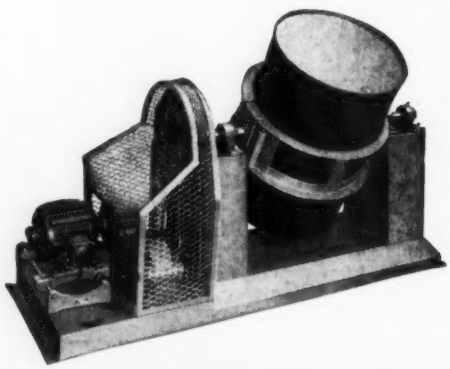
**DRUM ROLLERS**

Will roll any round container from a one gallon pail to a 70 gallon drum. Constant or variable speed drive. Available in sizes to handle one, two, three, or four drums.

**DRUM TUMBLERS**

Standard units are built to handle one or two 55 gallon drums. Variable speed control permits tumbling speeds ranging between 8 and 21 RPM.

Other "U. S." Mixing Equipment units include "roller-type" and standard Jar Mills, Ball Mills, Powder Blenders, Conical Blenders, Pail Rollers, Drum Cleaning and Painting Units, etc.



PROCESS EQUIPMENT DIVISION

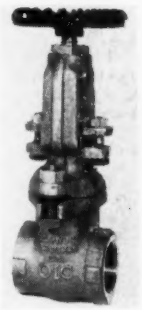
*Since 1865* **U. S. STONEWARE** *Akron, Ohio*


Studs imbedded by the driver withstand tensions of thousands of pounds—yet the driver itself weighs only 4½ pounds. Completely self-contained, the tool may be operated in any position or location, entirely independent of trailing cables, hoses, or outside sources of power. Its operation is comparatively silent, flashless and without recoil. Efficient utilization of the energy contained in a small blank cartridge supplies the power for the Model "B."

### *Stainless Steel Valves* QB 439

A new stainless steel valve has been added by The Ohio Injector Co.

The valve, manufactured in ½" to 2" sizes, is of the outside screw and yoke



type, having a bolted bonnet, tapered wedge, and screwed ends. It is so constructed that all materials in contact with the fluid are of low-carbon type 316 stainless steel. The packing and gaskets are corrosion-resistant. The yoke bushings, through which the stem rises, are renewable.

### *Plastic Safety Goggle* QB 440

Their new lightweight safety goggle, featuring an all-plastic frame with a single plastic acetate lens provides maximum vision, according to the American Optical Co.

The new AO 607 safety goggle is rec-

ommended for wear directly over eyes or over spectacles for frontal protection against flying particles. The design of the durable brown plastic frame provides unobstructed side vision, excellent frontal protection and smart appearance. No metal touches the skin.

The single plastic acetate lens in green or white color is easily replaceable.

# *Chemical plants are not bought on impulse*

There's a lot of serious thinking done first.

An organization must be chosen which will apply the same careful, individual thinking and planning to the design and construction of your acid plant as you give to the decision to have one built. Chemico is that kind of organization.

Long before the blue-print stage, Chemico analyzes your specific requirements and limitations. Desired capacity, kind and quality of raw materials, type and cost of available utilities, geographical location, existing facilities . . . all are factors that affect the design of the plant. When construction is completed you will have a highly efficient installation "tailor-made" to your particular needs.

Chemico has designed and built many hundreds of heavy chemical plants. This invaluable experience is your best assurance of satisfaction.

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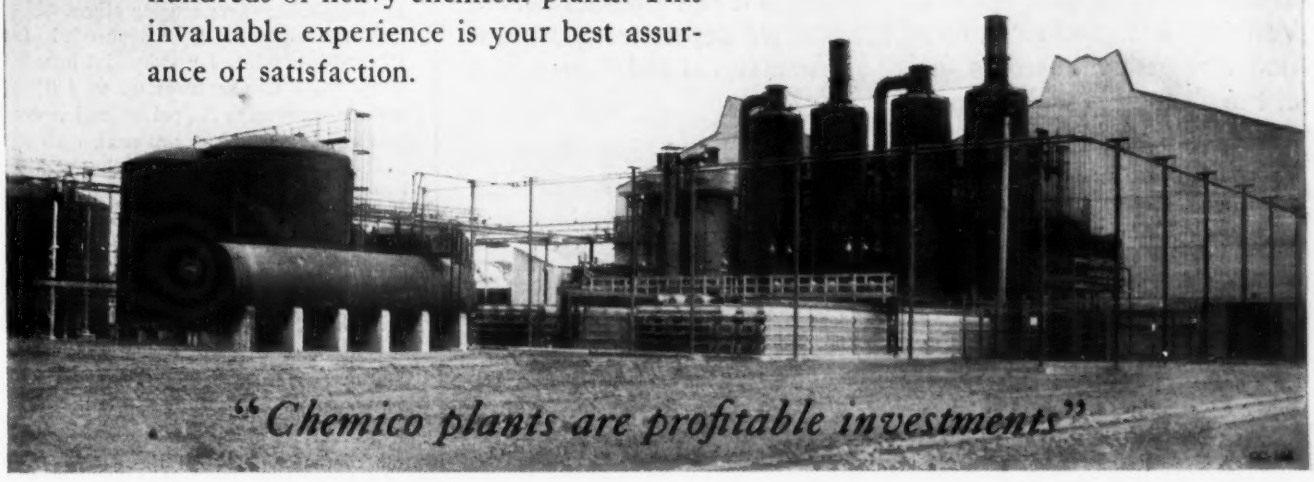
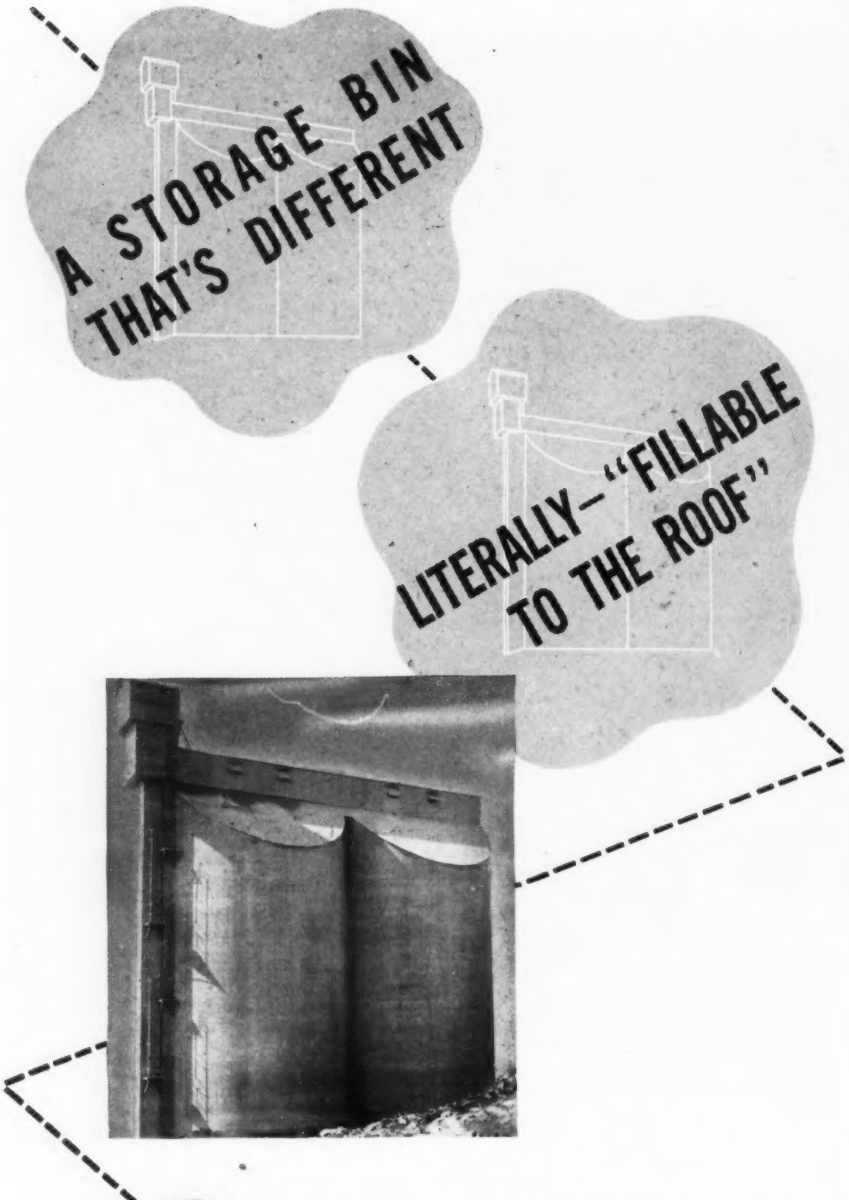
Cables: Chemiconst, New York



*"Chemico plants are profitable investments"*




Note the sloping roof of this bulk storage and handling plant! It's designed that way for two reasons: (1) the material handled, asbestos ore, has a natural slope of about the degree shown; therefore, when filled, there are no waste air pockets; and (2) the slope provides a good water shed and reduces the snow load in winter.

This storage bin, designed and constructed for an asbestos firm in Vermont, is a good example of the way we depart from conventional treatment when the nature of the material and the location of the plant call for the unusual.

Your project for concrete bulk storage and handling plant—if placed with Nicholson—will be in the hands of specialists broadly experienced in the design and construction of concrete bins and tanks.

THE NICHOLSON CO.

10 Rockefeller Plaza • New York 20, N. Y.


The metal temples, enclosed in acetate to prevent corrosion, are easily adjusted and hold the goggles snugly without irritation. Each goggle is supplied with a leatherette case.

### *Threadless Malleable Iron Socket Type Fittings* QB 441

The Flagg-Flow threadless fitting, recently introduced by Stanley G. Flagg & Co., is a black, malleable iron socket type fitting for brazing to steel or wrought iron. The cup of this fitting is reamed to accommodate the outside diameter of a standard pipe and also to produce a shoulder or stop for the pipe when it is inserted. Close tolerances in the machining of the cups insure rigid support and a thorough bond. This design materially reduces the pressure loss due to friction and turbulence.

*Brazing Flagg-Flow Fitting*

Welding allows production of a "one-piece" system but, except for special jobs, it is largely limited to pipe sizes of about three inches. About 20 years ago, manufacturers of brass and copper tubing developed a method of joining pipe by soldered fittings. Today, then, there are three general types of piping installation: the ordinary screwed pipe job made with threaded malleable fittings and steel or wrought iron pipe; the welded job made with larger sizes of steel pipe or with copper or brass tubing, and the soldered job.

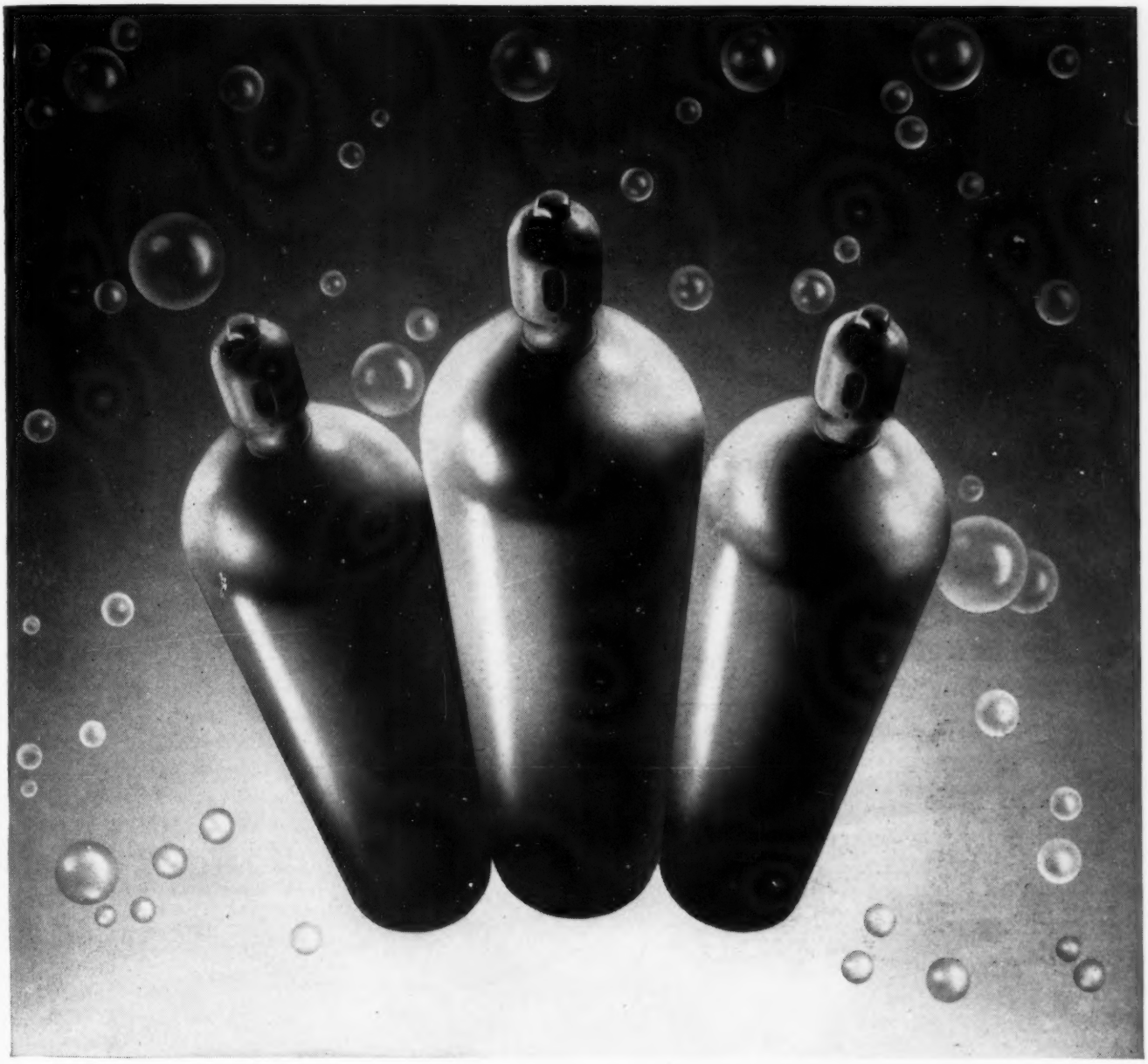
In effect, Flagg-Flow bridges the gap between a threaded steel job and an expensive welded or soldered steel or copper job, as Flagg-Flow connections can be made by using silver brazing alloys.

These alloys are recommended for Flagg-Flow joints for industrial installations where temperatures up to 450° F. and pressures up to 300 psi are anticipated. Black pipe and fittings are used, with the ends carefully cleaned of the coating material.

Silver brazing alloys melt at 1170° F. or higher, therefore an oxyacetylene torch is used to make the Flagg-Flow joint. No special equipment is required, and normal silver brazing techniques are employed.

### *Smoke Indicator* QB 442

Photoswitch excess-smoke indicator Type 2A1OC gives a continuous indication of the condition of the gases which



# LIGHTWEIGHT

## ...to lighten your costs

Hackney Cylinders are comparatively light in weight—to assure shipping and handling economies. They're strong, too—to give utmost protection. The Hackney Deep Drawing Process gives them both these desirable qualities—as it assures uniform sidewall thickness and eliminates all excess material. Then, too, the physical qualities are still further improved after complete fabrication by a special heat-treating method. For further details on this strong, lightweight cylinder, write us.

Hackney MILWAUKEE

**PRESSED STEEL TANK COMPANY**

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CONTAINERS FOR GASES, LIQUIDS AND SOLIDS

KNIGHT-WARE
CHEMICAL EQUIPMENT

# For Corrosives that 'BITE'!

Pictured are a few of many types of Knight-Ware acid-proof pipe and equipment in use wherever maximum resistance to acids, alkalis, gases and fumes is vital. Knight-Ware can handle all acids except hydrofluoric and, being non-conductive, is not subject to electrolytic action.

Other Knight-Ware chemical equipment such as jars, filters, tanks, towers, etc., has been designed by Knight engineers to solve specific problems for our customers. Most of these units are made in one jointless piece, each piece corrosion proof throughout. Compared with special designs in other materials, Knight-Ware gives maximum service yet costs you less.

If you have a problem involving the handling of corrosives, Knight engineers can help you solve it more economically. Write, giving as much data as possible concerning your problem.

**MAURICE A. KNIGHT**
**202 Kelly Ave., Akron, Ohio**

*S-trap*
*Chlorine header pipe*
*Gas diffuser pipe*
*Manifold*

are passing through the flue. It includes a photoelectric control light source and a densometer. The photoelectric control

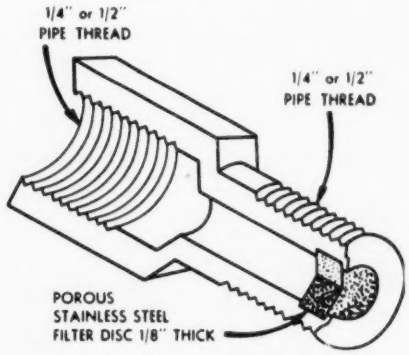
and light source are mounted on opposite sides of the flue or breaching. The beam from the light source projects through a small opening in the flue to the eye of the control. A tamper-proof sensitivity adjustment on the photoelectric control is set upon installation to compensate for flue dimensions and other variables.

Recording equipment to continuously record smoke density is also available for use with this equipment.

### *Pressure Snubbers* QB 443

Equipoise snubbers eliminate pressure gage fluctuations caused by pressure pulsation and vibration. By smoothing out pressures the gage indicates steady average pressures and protects the indicator mechanism against undue shock and wear.

An important feature of the snubbers is the porous stainless steel filter disc. The




CUT-AWAY SECTION

disc provides a relatively large filter surface and effectively prevents clog-up in pressure gage service.

The design permits easy installation into any pressure line for instrument protection; for clarification of small quantities of fluids; as a metering device; and as a protective medium for preventing mercury losses from manometers.

The maximum differential pressure rating of the standard types is 500 psi. Snubbers for use up to 5000 psi differential can be supplied.

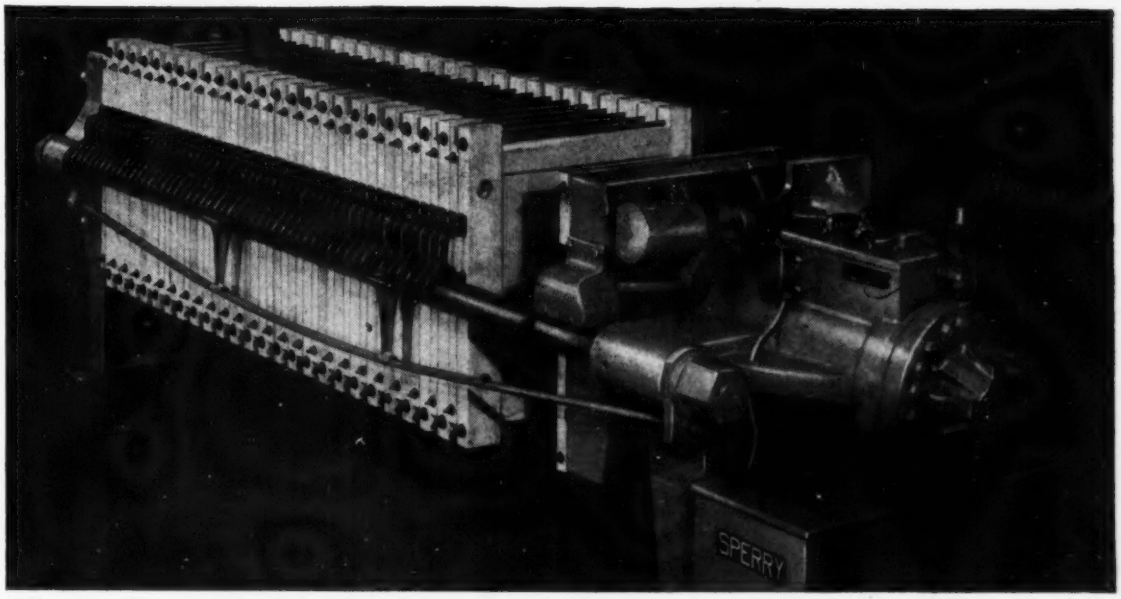
# YOUR MATERIAL

# ....IS OUR PROBLEM!

■ Sperry engineers are constantly faced with new and difficult problems in industrial filtration. If you have a material that requires filtration, send it to Sperry for analysis. This organization has solved many complex filtration problems for leading companies in the chemical and process industries.

The techniques employed by experienced engineers in our laboratories reproduce the exact conditions under which your material would be filtered in your plant...insure accurate and conclusive determinations. And our 50 years research and practical experience in designing and building industrial filtration equipment has provided invaluable data files and case histories of filtration experience from which to draw.

This Sperry service has provided hundreds of manufacturers the world over with filter equipment designed and built to perform its required function efficiently and economically. Take advantage of this service by submitting your material to Sperry today.

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*Filtration Engineers for Over 50 Years*

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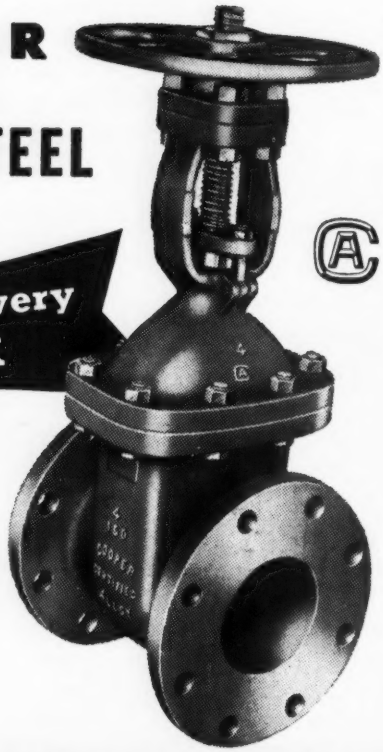
COOPER
CERTIFIED
STAINLESS STEEL
VALVES

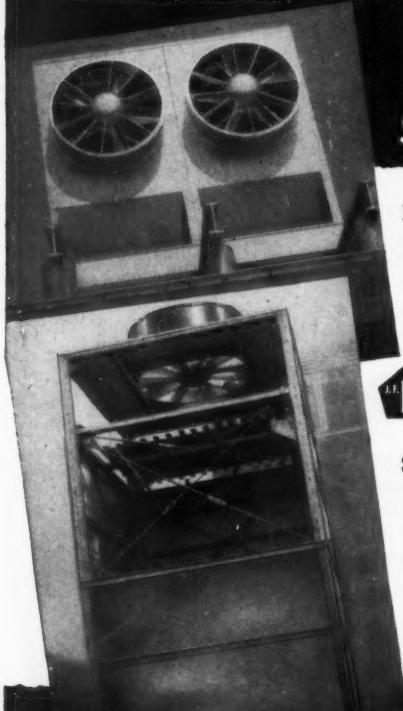
Immediate Delivery from STOCK



COOPER can make immediate delivery from stock on Standard Type Stainless Steel Valves. These include: GATE • GLOBE • Y • NEEDLE • CHECK and QUICK-OPENING . . . also on Stainless Steel Pipe Fittings and Accessories.

*Specialists in Corrosion Resisting Stainless Steel*
The COOPER ALLOY FOUNDRY CO.
HILLSIDE, NEW JERSEY

*Pritchard* Small and Medium-Capacity
COOLING TOWERS
*Shipped from Stock!*



**INDUCED DRAFT . . .**
Horizontal or vertical air flow, with the ultra-efficient Moore "Lifetime" Fans. No gears, no belts, no couplings, no corrosion problems. Heavy-duty All-Monel pressure blowers, trouble-free under most severe conditions. Slow-speed, ball bearing, direct drive motor is IN the hub. Other advanced and thoroughly proved mechanical and structural features throughout.

**NATURAL DRAFT . . .**
Standard spray towers or with coil systems in base, with or without basins or internal decks. Low pressure water distribution. Bolted assembly of Redwood or All-Metal, shipped complete.

**ALSO ALL OTHER TYPES AND SIZES;**
**20 YEARS OF COOLING TOWER LEADERSHIP**
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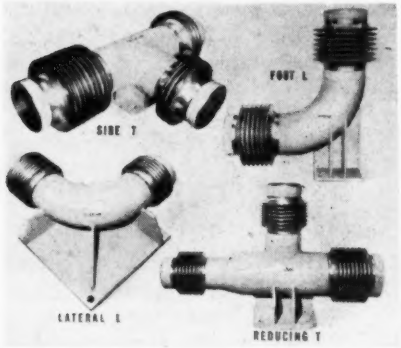
● QB 444 A new *Heavy Duty Industrial Apron* made of clear Koroseal film is available from The B. F. Goodrich Co.

The apron is resistant to acids, greases, caustics, gasoline, animal fats and blood, vegetable fats, solvents and soaps. It is made in two sizes, one 29″ by 35″ weighing 14 ounces and the other 35″ by 45″ weighing 1½ pounds, the aprons are of tape, hem and grommet construction, with all points of stress reinforced with a cloth insert covered with Koroseal film.

● QB 445 The Lyon-Raymond Corp. has added a 3,000 lb. capacity truck to its line of *Hydraulic High Lift Trucks.*

New features include four wheel suspension, a synchronized steering device and a towing eye as standard equipment.

● QB 446 Magnilastic, a division of Cook Electric Co., has added a new line of *anchor base expansion joint pipe fittings* to their six standard series of packless expansion joints. Four typical units are

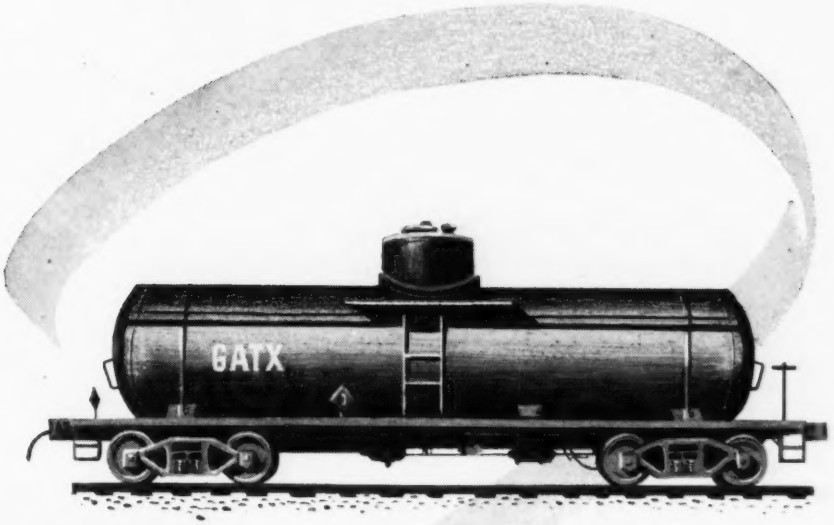



illustrated: a side "T", foot "L", lateral "L", and reducing "T", all of stainless steel. In the side "T" the number of bellows flanges may be varied to accommodate unequal expansion in each leg. Each of these particular fittings stem from the standard MagniLastic 400# series, constrtucted for steam lines.

This new line will supplement regular MagniLastic expansion joints which are made for a full range of pressures from 30″ of vacuum to 1000 psi. in pipe sizes from ½″ to 72″. Greater pressures and larger pipe sizes can be handled on special order.

● QB 447 The new *dial type thermometer* of the W. C. Dillon Co. is made with a flat stem to provide more accurate readings by clamping onto flat surfaces. Various sizes and metals are available with dial readings varying from 0-200° F., 50-500° F., 150-750° F. and 200-1000° F. Centigrade ranges are also available.

● QB 448 A new *Fork Lift Truck,* the Model LT-90, having a lifting capacity of 15,000 pounds, is available from Towmotor Corp. The LT-90 is similar in most respects to the nine other Towmotor fork lift truck models and may be used in conjunction with the various Towmotor fork lift truck accessories wherever special applications require.




# WHEN

## CAN YOU EXPECT

# MORE

## GENERAL AMERICAN TANK CARS?

When more materials are made available General American will build more tank cars. That's plain fact.

Right now, the GATX Fleet has more than 37,000 tank cars, of over 207 specialized types—but still not enough. Our customers have increased volume . . . expanded and acquired new plants—now need more tank cars than ever before. General American plant operations have been enlarged . . . productive capacity and effort has been stepped up, yet the growing demand far surpasses the new cars put into service. We are doing everything possible to relieve this situation, but total car production is controlled by our supply of materials. As fast as materials now on order are made available, we will once again keep our tank car supply equal to demand.

GATX GENERAL AMERICAN

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# PACKAGING & SHIPPING

*by T. PAT CALLAHAN*

### *Bags Printed with Customers' Code Markings*

Godfrey L. Cabot, Inc., has inaugurated a customer service which is unique in the carbon black and rubber industries. The Cabot company has completed installation of printing presses in each of its carbon black plants on which individually marked or coded bags are printed, on the spot, for manufacturers using its product.

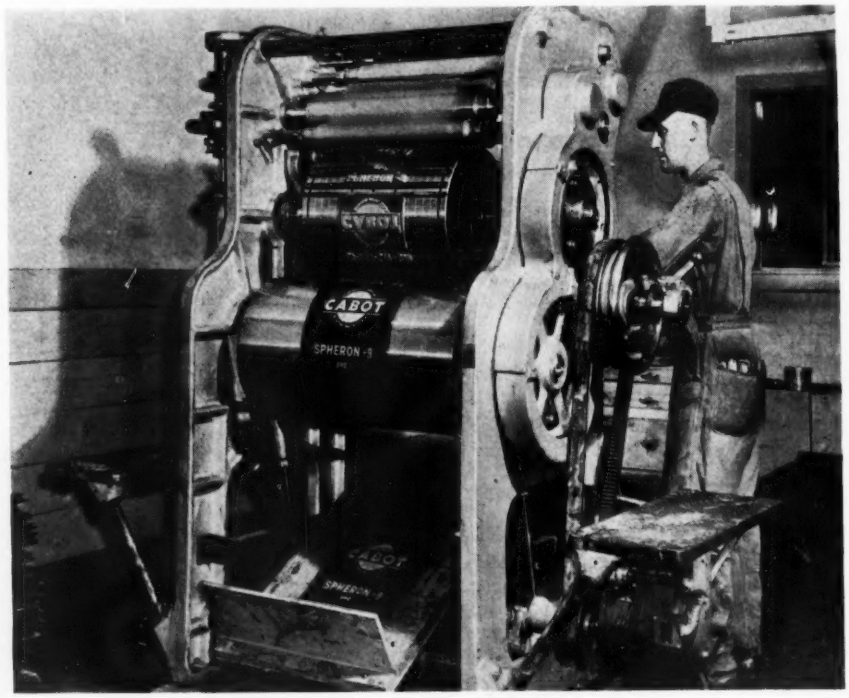
Ten of these large, electrically-driven presses have already been put into operation, and two additional presses are being set up. Thereafter, all Cabot and General Atlas black shipped in bags will be clearly identified by printed markings. The printed matter will include brand names and grades, net weight, and possibly more important, it will include the individual code numbers of each buyer.

The code numbers will be printed on the face and the bottom of each bag, so that no matter how the bags are stacked, mill hands in rubber plants will be able to find instantly the pigment specified in the recipe.

Bags for every order will be printed separately, not only for each customer but for each shipment, no matter how large or how small. This is made possible by the flexibility of the high speed presses. The printing equipment now in operation has a capacity of up to 2,400 bags per hour, and complete change-over of plates for any specified printing run is made in less than half an hour.

The presses are housed in new, special printing buildings of their own. These are outside the packing houses to insure that the bags are clean before they are filled.

The presses are so elastic in their capacity that they can print any bag now in use by the industry, whether domestic or foreign. Some export bags already have been printed and shipped. In addition to bags for shipment to destinations in the United States, Canada and Great Britain, the Cabot presses are printing bags in French and Spanish, and other languages will be added as required.

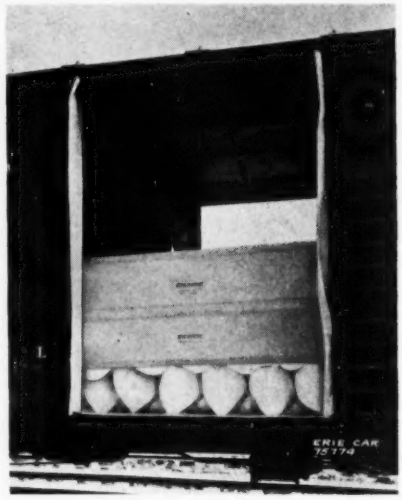



***Printing presses for all Cabot and General Atlas carbon black plants were ordered as a part of Cabot customer service. Bags are printed on the spot with brand name, grade, net weight, and customer markings for each individual shipment. Each press has a capacity of 2,400 bags an hour.***

### *Retaining Strip For Boxcar Doors*

A car door retaining strip, which replaces the conventional-type door barricade, has been perfected and tested by Signode Steel Strapping Company, Chicago, Ill.

This streamlined version of standard doorway blocking uses no lumber. Instead, strips of laminated, heavy-duty, water-repellent Kraft liner board, reinforced with ¾" x .020" Signode steel strapping, are nailed across the door opening inside the car. Depending upon the characteristics and weight of the load, the strips may be butted, overlapped or spaced for maximum efficiency. Light in weight, the average dunnage for a car door will range from 10 to 20 pounds. Retaining strips measure 18" x 84". With the substitution of smooth-surfaced retaining strips for wood-constructed door




bracings, damage to cartons, boxes, bales, bags and bundles from snagging and ripping on sharp edges and corners and protruding nails is eliminated, as is the need for car doorway liners. It is no longer necessary to "knock in" a doorway barrier; unloaders need only snip the steel bands on the retaining strips. Thus chances for damage to containers piled near the doorway are practically nil.

Signode also makes a complete retaining door, designed for doorway protection against seepage of bulk shipments—grain, chemicals, salt, cement, lime, gypsum, silica sand, and similar commodities. Doors are available in three sizes—3, 4 and 6-foot heights, each 84 inches wide.

### *Successful Case Sealing*

A brochure describing the various types of shipping containers, the adhesives required to successfully seal each type, and a description of methods of sealing has recently been issued by the National Adhesives Company, 270 Madison Ave., New York 16, N. Y. This brochure incorporates the latest methods of handling fiber shipping containers and may be obtained by contacting National Adhesives.

### *Dimethyl Sulfate Safety Data Sheet*

The Manufacturing Chemists' Association has announced the publication of Chemical Safety Data Sheet SD-19 on dimethyl sulfate, the nineteenth in the series of M.C.A. chemical product safety manuals. Designed for supervisory staffs and management, these manuals concisely present essential information for the safe handling and use of chemical products.

The new manual sets forth the impor-

Here's a way of packaging that can't be confined to industries where bags have been considered standard containers. St. Regis Multiwalls branch out! They move into completely new fields! They adapt themselves, adventurously, to all kinds of products. And wherever they go, they offer more economical, more efficient, and more sanitary packaging.

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tant physical and chemical properties of dimethyl sulfate; usual shipping containers and methods for unloading and emptying; container storage and handling; requirements for caution labels; and recommended personal protective equipment. Health hazards and their control are covered authoritatively in a section prepared by the Medical Advisory Committee of qualified physicians and toxicologists.

Chemical Safety Data Sheet SD-19 "Dimethyl Sulfate" may be obtained at 20 cents per copy from the Manufacturing Chemists' Association, 608 Woodward Building, Washington 5, D. C. Send remittance with each order.

## *Materials Handling Exposition in Cleveland*

The Second Annual Materials Handling Exposition was held in the Cleveland Auditorium, Cleveland, Ohio, during the week of January 12 to 16. This exposition was the largest of its kind ever held and was attended by upwards of 30,000 people during the week. Packaging engineers from all over the country attended, and in addition to a working display of several hundred pieces of equipment, demonstrations and moving pictures were shown throughout the entire week. Automatic handling of all forms of packages were demonstrated.

All forms of labor-saving automatic machinery, various constructions of pallets made from wood, paper, steel and aluminum, and conveyors of all kinds gave the visitor a full idea of the enormous industry now being developed by the manufacturers of articles for material handling. For example, there was shown a small electrical truck capable of carrying 1,000 pounds and an electrical lift truck capable of lifting 15 tons. All the way in between were intermediate types of automatic lifting equipment, the size of which depended on the user's conditions. This Materials Handling Exposition brought home to industry the tremendous strides that have been made in the materials handling field, and many economies will definitely be reflected as an outcome of visiting this show.

We are publishing this month and next descriptions of some of the handling equipment shown, as examples of the various articles which were demonstrated. All of them have received acceptance from industry and if used will definitely reflect economies in operation.

One of the outstanding features of the exposition was the Materials Handling Theatre, in which a schedule of film showings was kept up during the entire week. All of these movies showed the different methods of materials handling, and we are quoting the title and the company who showed them, as it is felt that anyone interested in these films could contact these companies for future showings.

The Story of the Best Location in the Nation
The Cleveland Electric Illuminating Co.

Up and Over
American Monorail Co.

# What's the profit story for you in this picture?

Twenty and more years ago, coffee grinders like the one in the antique store window, were in use in many American kitchens.

Today, housewives buy the brand and grind they want —more than 500,000,000 pounds of coffee a year— roaster-fresh and vacuum-packed in cans!

Why?

Because American Can Company invented the vacuum can for coffee. This can introduced roaster-fresh coffee to millions who had never tasted coffee at its best.

Perhaps—through its vast facilities and wealth of packaging experience—Canco can show you how to make more money through better packaging.

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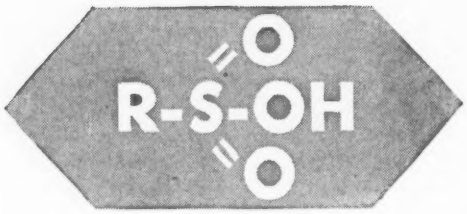
# ALKANE SULFONIC ACIDS




- Strong acids
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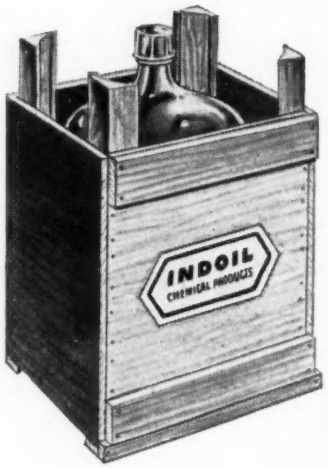
**MIXED ALKANE SULFONIC ACID**

**(methane—ethane—propane)**

Available in pilot plant quantities for limited commercial use.




**METHANE SULFONIC ACID**
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Available in limited quantities for research and evaluation.

**For further information send for Bulletin No. 11 and for price list.**

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Flow Process Chart . . . and How to Use It
Electric Industrial Truck Association

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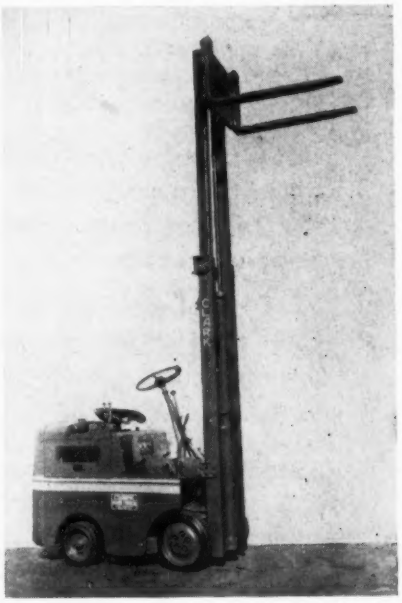
Liftall Forks in Action
Morrison Co.

Harvest in a Hurry
The Wooden Box Institute

### *High Tiering Clark Truck*

Clark Tructractor, Battle Creek, Michigan, showed its new type lift upright,



providing the higher tiering capacity which has proved successful on Clark

Uncanny Facts
$7127.00 per employee. That's the amount Continental has invested to provide the tools, plants and materials for each worker!
Mono means "one" ... in Greek! Famous Mono cups are so named because they're made to be used once—then thrown away. Germs can't hitchhike in these featherweight, sanitary containers made by Continental.
Cans are legal units of measure in the Netherlands East Indies! Oil cans are so widely used and recognized in this part of the Orient that the government has made cans standard measures of content!
More than 40 times around the world! That's the distance traveled each year by Continental service representatives, helping CCC's thousands of customers.
This comes straight from Will Rogers: "It's great to be great, but greater to be human." We heartily agree. That's why in 1948 advertisements like this will take you behind the scenes, dramatize little-known, intimate details—uncanny facts, if you please—about our company, the people who work for us, our services and the many products we now make.
We want you to know us, for in knowledge there is friendship and good business relations. So look for other human-interest stories from the great Continental family. They will add up to this: the bigger the family, the better the service.
The bigger the family ...
CONTINENTAL CAN COMPANY
...the better the service!

We hope this ad, now running in national magazines, will give you a broader and better picture of Continental. In *your* field, Continental's really in the picture with just about every size and type of container you could possibly want.

*For example:* "Tripletite" friction-plug containers, pails, square or oblong "F-style" cans – plain or lithographed with your own design.

For world wide service in MERCURY and MERCURIALS

ask Berk

PRIME VIRGIN MERCURY
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MERCURIC ACETATE
MERCURIC IODIDE RED
MERCURIC NITRATE
PHENYL MERCURY COMPOUND
WHITE PRECIPITATE
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"Carloader" and "Utilitruc" models, as standard equipment on its "Clipper" models at the Materials Handling Exposition.

The overall height of the basic standard lift is 83" with forks lowered, permitting passage through 7' doors. Maximum tiering height has been increased from 108" to 124".

### *New Yale Hand Truck*

The seventh in its line of battery-powered, handle-guided hand trucks was shown at the Materials Handling Exposition by Yale & Towne Manufacturing Co.

The new Worksaver model is a non-tilting electric fork "walkie," available in 1000 and 1500-lb. capacities. It is recommended for use in food processing plants, shoe factories, furniture plants, soap factories, textile mills, freight depots, paper mills, bottling plants, and in other applications where loads are comparatively bulky but not heavy.

The three main features of the Non-Tilting Fork Worksaver are (1) low cost due to simpler mast construction; (2) short turning radius, and hence greater maneuverability in congested areas and narrow aisles; and (3) light weight, making the Worksaver desirable where it must ride elevators.

### *Carboy Manual*

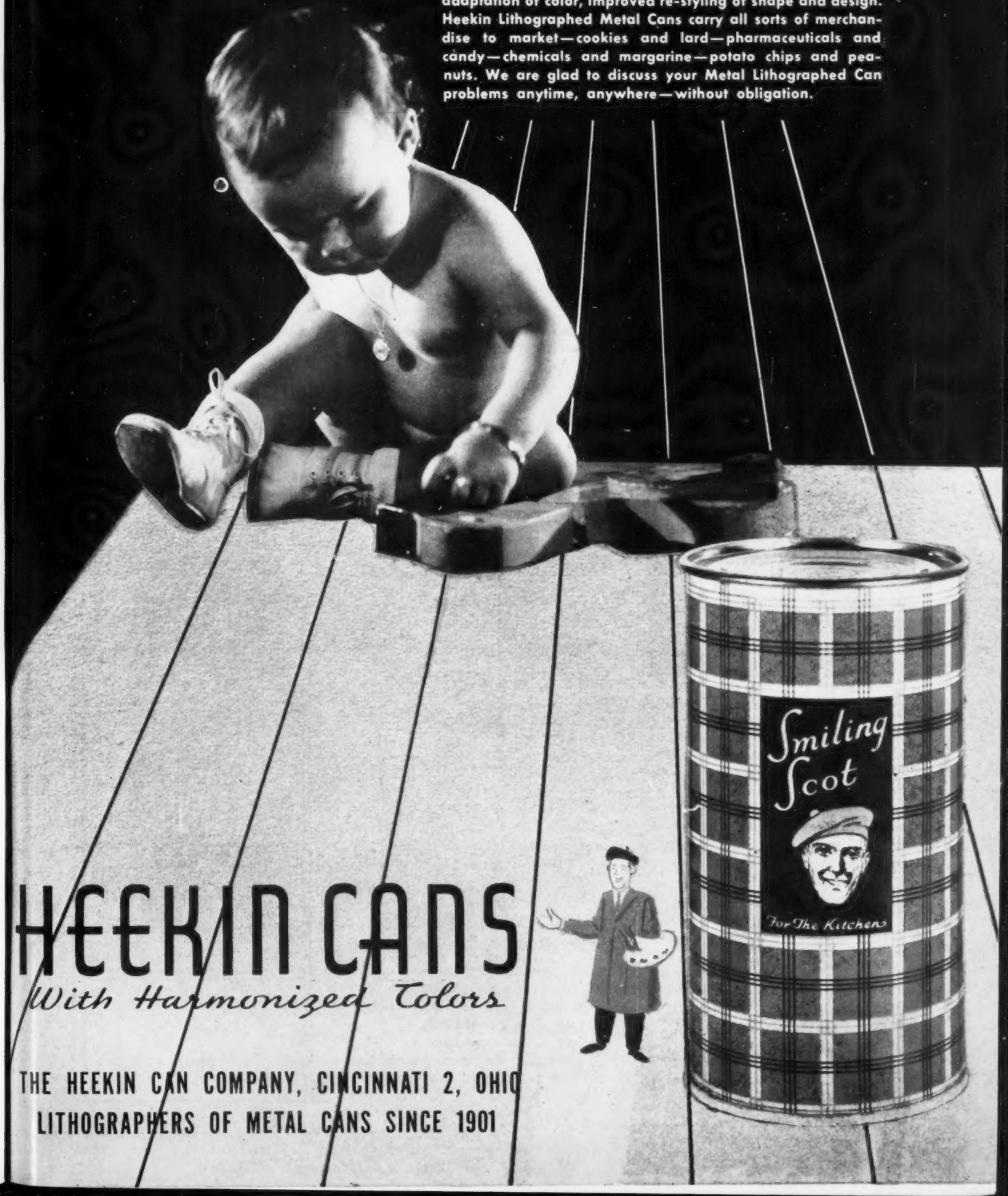
The Manufacturing Chemists' Association has issued Manual Sheet C-3A, covering specification for a standard 6½-gal. screw finish carboy bottle and closure.

In addition to the specification, the manual includes recommended manufacturing, marking, and inspection requirements, together with illustrations of the bottle and both types (venting and non-venting) of closures.

Copies can be obtained at 20¢, postpaid, from the MCA Washington office.

# THE BEST THINGS IN LIFE START OUT SMALL . . .

IDEAS . . . like babies . . . start out small. We, here at Heekin, have an idea that we can help you in your Metal Can problems through improved package design, improved adaptation of color, improved re-styling of shape and design. Heekin Lithographed Metal Cans carry all sorts of merchandise to market—cookies and lard—pharmaceuticals and candy—chemicals and margarine—potato chips and peanuts. We are glad to discuss your Metal Lithographed Can problems anytime, anywhere—without obligation.




# HEEKIN CANS

*With Harmonized Colors*

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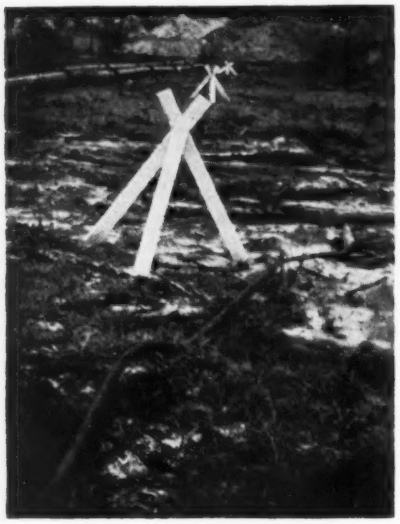
# PLANT OPERATIONS NOTEBOOK

## *High Voltage Trailing Cable*

Adequate safety, when using high voltage trailing cable, has always been a problem. In this connection the experience at the Saddle Creek mine of the American Cyanamid Co. is of interest.

There the trailing cable carries 4000 volts from the main power line to the electrically operated drag lines. The cable used has a tough plastic jacket and has been colored red to remind the workers to use caution when working adjacent to the cable.

Each conductor of the three-wire cable is covered with a metal sheath woven around the outside of the insulation provided for the individual wires. Each metal sheath is in contact with the metal sheaths on the other two wires, and ground wires are set in the spaces between



***A view of the rough muddy terrain at the Saddle Creek operation over which the power must be transported to the digging equipment. A trailing cable may be seen in the foreground.***

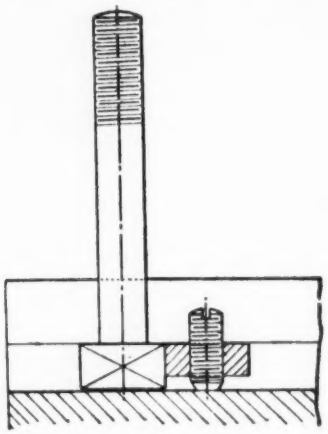
each metal sheath and in contact with them. The entire cable is covered with tough plastic insulation and is produced by the General Electric Co.

In the event of a break or "fault" in any part of the cable, the current leakage is carried off by the metal sheathing, the ground wires or both. The current proceeds along the sheath to a protective panel, located between the trailing cable and the main power line. Such a current energizes a ground relay and trips the main switch to cut off all power. The amount of electricity allowed to escape through the outer insulation is regulated to limit the potential to ground to a value between 60 and 100 volts, enough to provide a warning but not enough to cause injury.

***A reel of the trailing cable used in the operation. The three individual wires and the metal sheaths can be seen in the cut-off cable end, the whole being surrounded by a plastic covering.***

## *How to Make a "Bolt-Holder"*

A simple and easily constructed device to prevent bolts from sliding out of slots is shown in the accompanying sketch. In this device a nut is placed in the slot and tightened in place as shown. If the slot

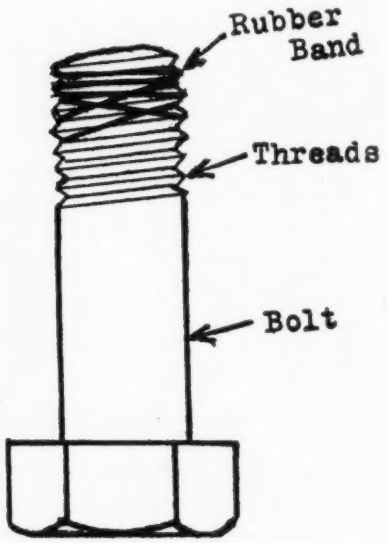


is vertical a nut below the bolt will be sufficient while if the slot is horizontal a nut is required on each side.

## *Locking a Nut with a Rubber Band*

An ordinary rubber band can be converted into an effective nut lock by wrapping a rubber band in tension tightly around the threads of the bolt.

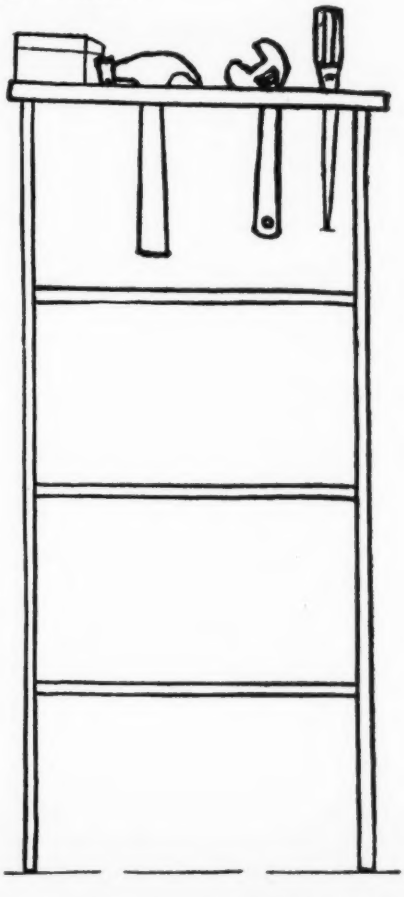
The nut is then turned on, the rubber band preventing the nut from working loose. The rubber band will very likely be "chewed up" by the threads when screwed in place, but the "particles" of rubber remaining between the nut and bolt will continue to aid in doing the holding.




## *Improve Your Stepladder*

As shown in the accompanying sketch, a step ladder or for that matter any other ladder can be improved by fitting the top with a holding slot or holes in the top of the ladder to hold the tools most in use.

In addition it is possible to attach a box to the top to hold nails, screws, etc. Such a box must of course be provided with a cover which can be locked so that the small parts will not spill out when the ladder is being moved from one location to another.



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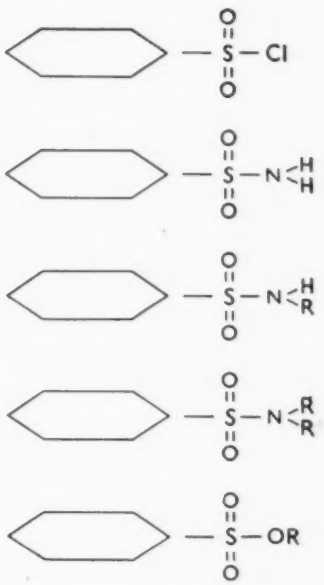
Address inquiries for samples and information concerning the properties and uses of these products to the Development Department. Our technical staff stands ready to aid you.



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*N, N-di-n-Butyl Benzenesulfonamide*
*Methyl Benzenesulfonate*
*Ethyl Benzenesulfonate*
*n-Propyl Benzenesulfonate*
*n-Butyl Benzenesulfonate*
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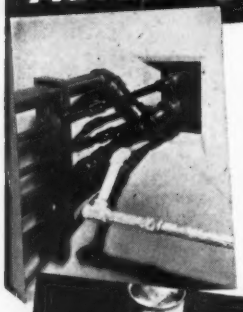
PLASTIC
PIPE and TUBING
Advantageously?



Typical installation of plastic pipe in a chemical plant, with other pipe alongside.

Plastic tubing used in fumigating boxcars.

●

With the right type of plastic and within the range of applications for which it is fitted, plastic pipe and tubing often possess distinct advantages over other kinds.

Thousands of chemical plants have proved this in installations which have stood up for years under conditions which no other type of pipe or tubing could endure.

Consult our Engineering Department for a frank and unbiased opinion on any application you may have in mind, or send for our new catalog No. C 47.

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*Readers are invited to submit for publication in this department any original nomographs pertaining to chemistry or engineering. $10 will be paid for each one used.*

# *Nomograph for Determinaiion of the Diameter of a Heat Exchanger Tube Sheet*

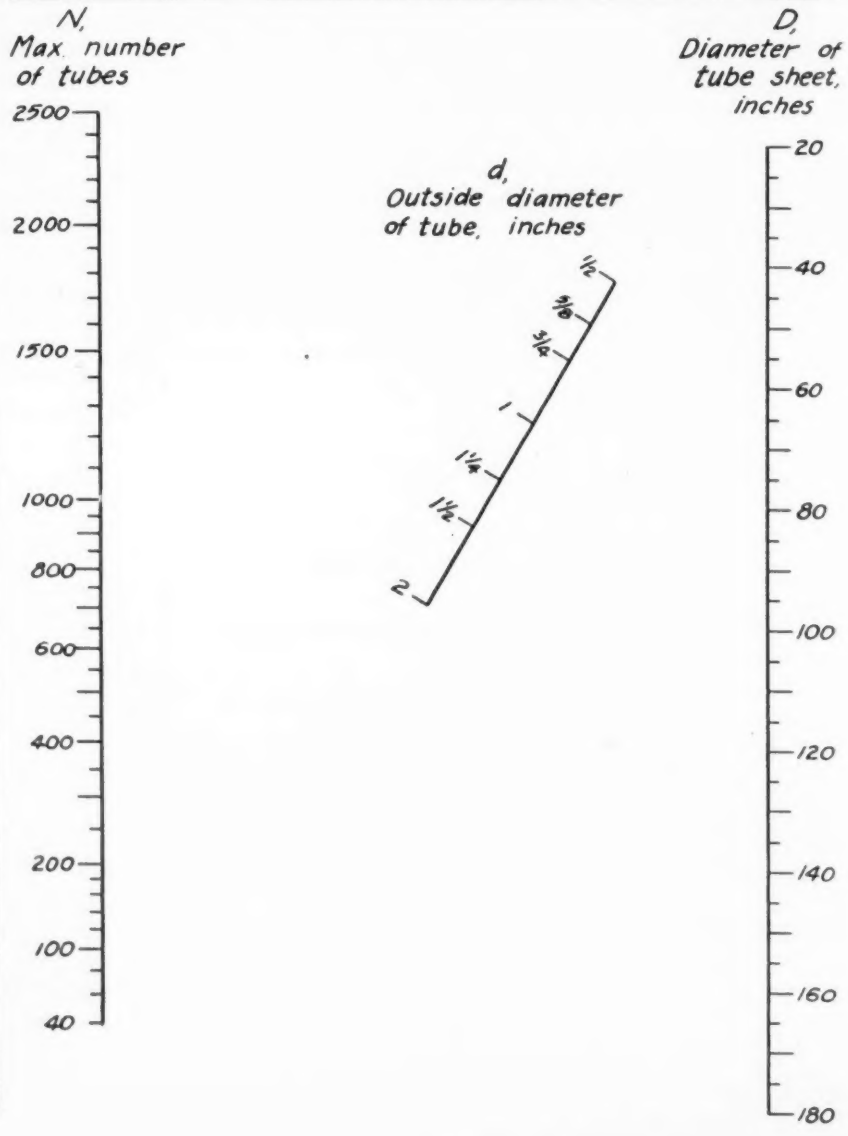
*by D. S. DAVIS*
*Government Laboratories*
*University of Akron*
*Akron, Ohio*

THE diameter D, in inches, of the tube sheet of a shell and tube heat exchange is given by the equation[1]:

$$D = \left(\frac{1.5d + 0.125}{3}\right)\left(\sqrt{69 + 12N} - 3\right) + d$$

where d = outside diameter of tube in inches and N = maximum number of tubes.

The accompanying nomograph, constructed by methods described previously[2] for equations with recurrent variables is convenient when designing heat exchangers of the shell and tube type. The use of the chart is illustrated as follows: What should the diameter of the tube sheet be when 800 tubes each 1¼" in outside diameter are employed? Connect 800 on the N scale with 1¼ on the d scale and read the diameter of the tube sheet on the D scale as 65".




### *Literature Cited*

(1) Cook, L. H. and Tolman, Russell, Chem. Eng., *53* (3) 128 (1946)
(2) Davis, D. S., "Empirical Equations and Nomographs", Chap. VI, New York McGraw-Hill Book Company (1943)

When the once-familiar cry of "Any ice today?" heralded the ice wagon's arrival, some 50 years ago... studies and experiments in the development of light fraction petroleum refining were already begun at Standard Oil.

From this work came the many Esso Solvents that today serve the most exacting needs of the paint, rubber, textile, refrigeration and other industries.

**The gleaming** enamel finish of the modern refrigerator, its pliable rubber trays, its silent ice-making machinery, are just some of the parts where Esso Solvents can be used.

**Whatever** your manufacturing process...whatever your solvents requirements... you can be sure that Esso Solvents and our staff of technical experts can help you solve your problem. Call or write our office nearest you.

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**STANDARD OIL COMPANY OF PENNSYLVANIA**—Philadelphia, Pa.

## GRAVITY CONVECTED OVENS

**Thermostatically Controlled Heat to 260° C. ± 1.0° C.**

**For quick dependable sterilization and heating. Easy to clean, interior is of stainless steel, and exterior of steel finished in rust resistant baked on grey enamel.**

**A heavy layer of insulator approximately 3″ thick is placed between the inner and outer chamber to prevent heat radiation. The heater bank of "blac-heet" nichrome coils running through porcelain refractories cover the entire base of the cabinet.**

**Operating at low thermal temperature, the heater bank responds to the thermostat immediately, giving complete control within the working chamber.**

**Doors are double gasketed to prevent air leaks and have a 3″ insulated layer between inner and outer wall. The sterilizer may be had with a built-in triplex, heavy duty viewing window, desirable when continuous visual control of the working chamber is required.**

**LOW TEMPERATURE OVENS**
**35 - 180° C.**

| Model # | Interior | Price (regular) | Price (with window) |
|---|---|---|---|
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# LABORATORY NOTEBOOK

## *Humidity Indicator*

A new all-metal humidity indicator has been designed by the Weston Electrical Instrument Corp., Newark, N. J. It provides readings of relative humidity accurate within ±1% for general conditions.

The instrument is of wet and dry bulb type, featuring self-supporting wet-bulb

wick covering the thermal element, and a simplified slide rule calculator giving relative humidity reading directly, thus eliminating the need for tables or psychrometric charts. The unit can be swung if desired to create air movement. The only maintenance necessary is to change wick occasionally and replenish the water in the reservoir, which is a heavy-walled, large-capacity jar, covered to reduce undue evaporation.

The slide rule calculator indicates relative humidity from 10% to 100%. With one movement of the slide the proper setting is made according to the readings of the two thermometers, and the per cent humidity is shown immediately on the upper scale. The instrument requires no calibration.

## *Electron Diffraction Instrument*

A new research tool designed to aid in the observation and measurement of surface conditions of metals, ceramics, and plastics has been developed by the Special Products Division of the General Electric Co. An electron diffraction instrument, it is valuable in the investigation of problems associated with corrosion, catalysts, lubricants, metallurgy, pigments, surface deposits, and graphite. It shows the crystal structure of surfaces and thin specimens up to 500 Angstrom units.

To operate, a beam of electrons is directed at the specimen being tested, and any resulting diffraction pattern is photographed.

The instrument consists of one unit containing vacuum chamber with specimen manipulator, visual and photographic recording camera, electron gun and beam focusing elements, regulated high voltage power supply, and complete vacuum pumping equipment.

The specimen chamber permits examination of specimens ranging from 0.1 to 4 in. in diameter. In many cases, the instrument will detect and help identify the very first chemical changes before they are detectable by other means.

## *Pipette Micro Conductivity Cell*

A micro conductivity cell that operates with minute liquid samples is offered by Industrial Instruments, Inc., 17 Pollock Ave., Jersey City 5, N. J. Originally designed for the study and checking of human eye fluids, this Type G-100 conductivity cell operates with only .05 to .10 cc. of solution. The cell constant is 100. Squeezing and releasing the rubber bulb draws the minute liquid sample up into the thick-walled glass tube where it comes in contact with precisely spaced electrodes. Electrical connections are established by clip-on terminals snapped over external bands on the glass tube, which in turn are wired through the glass to the electrodes.

## *Surface Roughness Measurer*

An instrument designed for measuring the surface roughness of calendered raw rubber sheet or similar samples is being

manufactured by the Precision Scientific Co. of Chicago. The measurement made is essentially the resistance to flow of air

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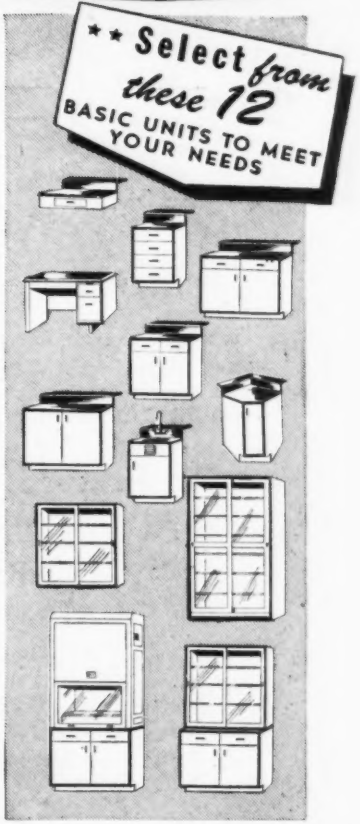


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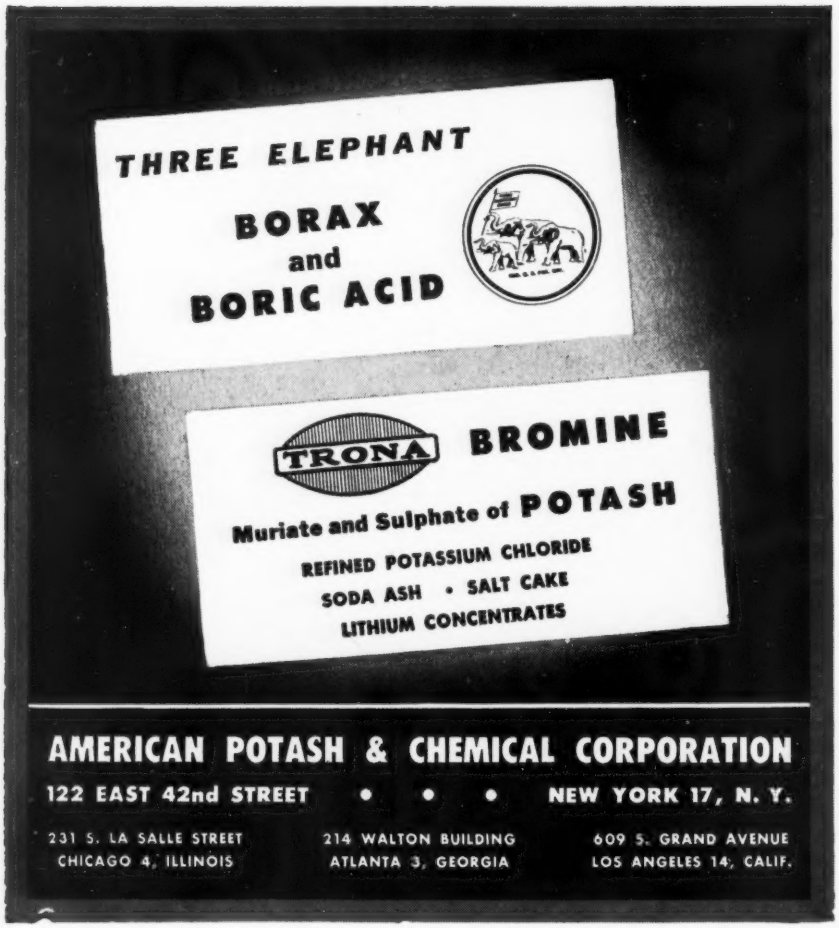


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between the rough surfaces and an annular test plate which rests upon the surface under the test.

The apparatus consists of the following elements in series: a constant-pressure air valve, a large needle valve with a calibrated scale, a manometer and an annular test plate. The needle valve is opened to the point at which the pressure on the manometer is one-half the pressure maintained by the constant-pressure valve. The resistance of the needle valve to the air flow is then equal to and measures the resistance of the test plate on the sample.

### *Ultramicroscope Technique*

More durable plastics and more elastic rubber are promised by a new microscopic technique utilizing color photographs, according to Professor Ernst A. Hauser, of Massachusetts Institute of Technology.

With an ultramicroscope scientists can inspect enlarged and sharply defined reflections of tiny particles of rubber, soap, plastics, and other materials too small to be visible under an ordinary microscope. Color film, because of its extremely fine grain, is ideally suited to photographing what the ultramicroscope reveals.

The new photo-ultramicroscopic technique has already been successfully applied to studies of natural and synthetic rubbers and several plastics.

The effect of chemical reactions or mechanical treatments and different temperatures upon rubbers, plastics, soaps, and other so-called lyogels has also been recorded photographically and it has been possible to observe such changes as are caused by vulcanization, stretching, or polymerization.

To obtain the best results, the material to be studied is deposited on a fine wire mesh, with 200 to 300 openings per inch, and the photographic equipment must be of such construction that it permits continuous observation of the preparation and the making of exposures, just as if ordinary snapshots were being taken.

Since ultramicroscopy is, in contrast to normal and electron microscopy, based on the reflection of the illuminating radiation from interfaces, and not on absorption, the best photomicrographic recording calls for plates or films of the finest possible grain.

Therefore, it could be expected that color film, which practically lacks resolvable grain after processing, would be best suited for this work. Besides this, its layered structure offers a photomicrograph with far more depth than that obtainable with black and white film.

This is particularly important when taking photomicrographs of preparations which contain matter in the form of strings or droplets. For reproduction, one can either make enlarged color prints or reversed black and white prints from the transparency.

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# INDUSTRY'S BOOKSHELF

## *Plastics Encyclopedia*

MODERN PLASTICS ENCYCLOPEDIA. Plastics Catalogue Corp., N. Y., 1947; 1575 pp., price $8.50 (Canada, $11, Foreign, $12). Reviewed by Howard C. E. Johnson, Managing Editor, CHEMICAL INDUSTRIES.

THE PLASTICS Encyclopedia of 1947 is bigger and better than ever. Having reached the size of 1575 pages, it is now published in three volumes, of which the third is a compilation of helpful charts.

Much of the older information has been rewritten, combined and condensed in order to make room for new material.

New features include charts on fiber properties and low-pressure laminating resins; three articles and a chart on sheets and films; information on resin treatment of fabrics; data on optical properties of plastics; a bibliography of reports on German plastics; and articles on continuous low-pressure and cellulose-derived laminates, pulp and solvent molding, heat-sealing and cementing of thermoplastics, and transfer presses.

Articles, as in previous editions, are written by experts, and extensive but judicious use has been made of illustrations. Good indexes and a body of trade information add to the abundant usefulness of this publication.

## *Engineering Text*

UNIT PROCESSES IN ORGANIC SYNTHESIS, edited by *P. H. Groggins*. McGraw-Hill Book Co., New York, 3rd ed., 1947. xiii 931 pp., $7.50. Reviewed by Herman W. Zabel, Engineering Editor, CHEMICAL INDUSTRIES.

THE THIRD edition of Groggins' well-known text represents an expansion of 140 pages upon the outline used in the previous edition.

One strong criticism to be leveled at the new text is the lack of attention paid to the prewar German literature. For example, no mention was found of the very interesting studies of Asinger on the mode of attack on the paraffin molecule by various reagents. Asinger's work on halogenation in all cases supports the earlier conclusions of Hass and co-workers, but he has extended it to cover sulfochlorinations and nitrations, indicating that Hass's rules on halogenation are quite probably general and not specific for halogen reactions.

The reviewer also feels that in many cases too much space has been devoted to the quite often inaccurate "details" revealed in patent literature. Cutting down on much of this material would go far to reduce the bulk of this 900-page text.

## *Rubber Library*

A nation-wide library service to promote scientific investigation in the rubber industry has been established by the Division of Rubber Chemistry of the American Chemical Society.

Beginning in January, 1948, the new service will function at the Bierce Library of the University of Akron, where a vast literature recording development in the field of rubber technology will be centralized and made available to cooperating libraries throughout the country. A committee representing leading companies in the rubber and chemical industries will administer the service.

All journals of special interest to investigators in the fields of rubber, resins, and plastics will be accessible in every state. Publications may be obtained through the service by applying to any cooperating library, which in turn will obtain the desired material from the University of Akron on a loan basis. The University of Akron may lend a specific journal directly, or may arrange the loan through one of the cooperating libraries. Journals may be supplied either in the original or on microfilm.

The initial list of publications has been assembled with the assistance of the Firestone Tire and Rubber Company, The General Tire and Rubber Company, The B. F. Goodrich Company, The Goodyear Tire and Rubber Company, The United States Rubber Company and the University of Akron.

The committee has invited other libraries having sections devoted to the rubber and plastics field to cooperate, so that the collection of journals may be as extensive as possible. The Division of Rubber Chemistry will help to fill gaps by utilizing the American Chemical Society's facilities to find missing journals, and where necessary by purchasing journals to be deposited in the Bierce Library.

Libraries interested in participating may write either to the librarian at the University of Akron or to Dr. B. S. Garvey, Jr., Sharples Chemicals, Inc., Philadelphia, chairman of the Rubber Division's library committee.

## *Other Publications*

POLYMERIZATION OF ACETYLENE TO CYCLOOCTATETRAENE by Karl Kammermeyer. A translation into English of various PB reports. Hobart Publishing Co., Washington 15, D. C., 130 pp. Price $17.50.


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| | |
|---|---|
| Crystal Structure | Tetragonal |
| Molecular Weight | 183 |
| Molecular Volume | 38.7 |
| Moh's Hardness | 7.5 |
| Thermal Conductivity cal/°C/sec/cm/cm² (up to 700°F=0.031 Watts/in²/in/°F) | 0.0046 |
| Refractive index Ne | 1.94-2.02 |
| Refractive index for No | 1.92-1.96 |
| Birefringence | 0.045-0.058 |
| Mean Specific Heat (21-51°C) | 0.132 |
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| Melting Point | 4622°F |
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|---|---|---|
| Dielectric Constant E | | 12±1 |
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"sec-Butylbenzene". Technical Bulletin C-7-104. Chemical Div., Koppers Co.

**Insecticide** B364
"Direct Control of Grasshoppers, Alfalfa Weevil, and Lygus Bug, with Chlordane". Technical Supplement 201A, Julius Hyman & Co.

**Chemical Catalog** B365
Sheets describing Victor chemicals. 48 pgs., Victor Chemical Works.

**Resins** B366
"U. S. I. Resinews". 146 pgs., Vol. XV, Oct., 1947, U. S. Industrial Chemicals.

**Pyrethrin Synergists** B367
"Pyrethrin Synergists", Octacide 264. 10 pgs., Van Dyk & Co.

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"Laboratory Equipment and Supplies for the Chemical Bacteriological Clinical and Biological Laboratory". 484 pgs., Catalogue 65 & 70, Standard Scientific Supply Corp.

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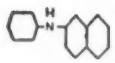
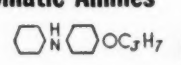
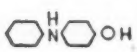
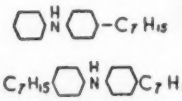
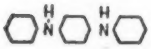

Phenyl B-Naphthylamine

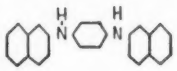

p-Isopropoxy Diphenylamine


p-Hydroxy Diphenylamine

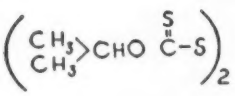

Mixed Mono and Diheptyl Diphenylamines

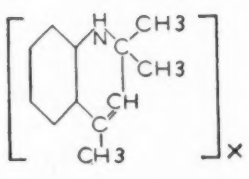
### Di-secondary Aromatic Amines

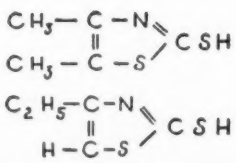

Diphenyl p-Phenylenediamine


Di B-Naphthyl p-Phenylenediamine

## *Miscellaneous*


Di-Isopropyl Dixanthogen


Trimethyl Dihydro Quinoline Polymer


Mixed Ethyl and Dimethyl Mercaptothiazoles

N-Nitroso Diphenylamine

All materials listed here are available in commercial quantities. Prices and technical information are available on request. Please write Dept. CE- **2,** B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

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# NEWS OF THE MONTH

## *Decide to Release Foreign-Origin Patents*

The Office of Alien Property, Department of Justice, will soon make available to American industry a large number of patents now held by corporations in which the government has seized a controlling stock interest under the Trading with the Enemy Act. It is estimated that the program will affect over 6,000 patents owned by 25 corporations.

Included in this policy will be valuable patents in the dyestuffs, photographic, chemical, pharmaceutical, mechanical and textile fields.

The Attorney General states that he regards the adoption of this policy as an important step in promoting competition in the fields affected. The patents involved are essentially German in origin, were acquired by companies when they were under German control, and the decision to make the patents available to anyone who wanted them should reduce the possibility of a resumption of cartel agreements between the companies involved and German concerns in the same field.

Licenses will be offered at reasonable terms to persons applying David L. Bazelon, director of the Office of Alien Property states. Ordinarily, they would be granted by the company concerned, but if the company should refuse a license an application can be made to the Office of Alien Property.

## *Coleman Joins Evans*

***H. Roger Coleman, appointed to the staff of Evans Research & Development Corp. He formerly was manager of the special products division, General Aniline and Film.***

## *New Set-Up Speeds OTS Report Availability*

Business firms and individuals in Washington, D. C., area and firms maintaining representatives in Washington can now obtain immediate service on their requests for a majority of American and foreign technological reports distributed by the Office of the Technical Services, Department of Commerce.

Mimeographed and printed OTS reports can be obtained over-the-counter at the special business service sales counter maintained by the Government Printing Office in the lobby of the Commerce Department Building on 14th Street, Northwest, Washington.

Reports available in photostat or microfilm form cannot be obtained at the counter, however, because usually only one copy exists and several days are required to process reproduction orders at the Library of Congress or other government libraries where the original report is deposited. Nevertheless, the more popular reports have been mimeographed in quantity in order to provide more rapid distribution of the material in larger demand.

## *Detail Processes for Insecticide Manufacture*

The preparation of fluorobenzene for use in "GIX," an insecticide analagous to DDT but using fluorobenzene in place of monochlorobenzene, and the composition, method of manufacture, and testing of GIX and certain other German insecticides are described in three mimeographed reports now on sale by the Office of Technical Services, Department of Commerce.

GIX, an insecticide developed at the plant protection laboratory of I. G. Farbenindustrie at Hoechst, consists of 60 per cent "fluor DDT" (1,1-bis(p-fluorphenyl)-2,2,2-trichlororethane) and equal amounts of emulsifying agent and paraffin oil.

The reports are: PB-77670, PB-360, PB-224B. Prices: 50c, 25c, and 75c, respectively.

## *Labor Dept. Checks Wage Violations*

Violations of the minimum wage, overtime and child-labor provisions of the Fair Labor Standards Act and the Public Contracts Act were found in 49 per cent of the 1,052 inspections in the chemicals and allied products manufacturing industry, according to the 1947 Annual Report of the Wage and Hour and Public Contracts Divisions, U. S. Department of Labor.

Just issued to the Congress, the report, which covers the 12 months ended June 30, 1947, shows that chemical industry inspections resulted in back wages amounting to $270,957 agreed or ordered to be paid to 5,291 employees.

While most violations revealed had resulted from improper computation of overtime pay, it was found also that there were employers who had failed to pay some of their employees the 40-cents-an-hour minimum wage required under the Fair Labor Standards Act—the Wage and Hour Law. In all, it was shown that 695 employees in this industry had been paid less than the minimum wage at some time during the period covered by the inspections.

Wm. R. McComb, Administrator of the Divisions, points out that the violations disclosed are not necessarily representative of the industry's compliance record as a whole, since the Divisions make inspections "where there is a high degree of probability that violations will be found."

## *Wyandotte Promotes Weller*

***Paul Weller, made director of market research, Wyandotte Chemicals Corp. He completed graduate work at Ohio State University, and has had engineering experience with Goodyear Tire and Rubber Co.***

## *Plan Revamped Wood Preservative Specifications*

The Rural Electrification Administration expects to complete work on revised wood preserving specifications for poles and similar products within the next several weeks, preliminary to their promulgation later in the year.

As now shaping, it is not expected that the revised specifications will differ greatly from the standard requirements that governed in peace-time, when many chemical components were in better supply than during the war-time shortage era.

During the war, of course, it was necessary to have a new category of specifications — war — as distinguished from standard, because of the many shortages.

It is expected that the standard specifications will be largely a consolidation and restatement of former requirements.

One particular objective of REA is a catalogue of all special dispensations as to preserving compounds, with a view to reducing these to a minimum, and limiting them to the listed methods, so as to preclude necessity of constantly issuing some special authorization.

The proposed revisions have been placed before a number of purveyors of wood preserving components, including wood-tar, creosote, oil and tar creosote, and others.

Present estimate is that the new specifications cannot be put in effect for about six months after they are completed.

### *Pennsalt Plans Western-Southern Fluorine Project*

Pennsylvania Salt Manufacturing Co. has completed plans for the construction of a new fluorine chemicals plant near Paducah, Kentucky.

Work will be started in the near future and the first unit of the plan is expected to be completed by February, 1949. The new plant ultimately may include other products and is expected to be one of Pennsalt's largest. The first phase of the new plant's operation will be devoted to production of hydrofluoric acid.

The plant site is directly north of Calvert City, between Paducah and the new T. V. A. Kentucky dam at Gilbertville, from which the plant will receive its electric power. The operation will occupy approximately 10 acres of a 500-acre tract which Pennsalt has contracted to purchase and will utilize Kentucky and Illinois fluorspar deposits, in which Pennsalt has reserve interests.

### *Westvaco Names Miller*

*James Gilbert Miller, appointed resident manager of Westvaco Chlorine Products Corp.'s new phosphorous plant, now being constructed at Pocatello, Idaho. He has been with Westvaco since 1930.*


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## CALENDAR *of* EVENTS

*AMERICAN ASSOCIATION OF CEREAL CHEMISTS*, 33rd annual meeting, Netherlands Plaza Hotel, Cincinnati, May 23-28.

*AMERICAN CHEMICAL SOCIETY*, 113th annual meeting, Stevens Hotel, Exhibition Hall, April 19-23.

*AMERICAN GAS ASSOCIATION*, spring conference, Windsor, Ontario, Canada, April 7-9.

*AMERICAN INSTITUTE OF CHEMISTS*, annual meeting, Hotel Pennsylvania, N. Y., May 8.

*AMERICAN MANAGEMENT ASSOCIATION*, 17th annual packaging exposition, Public Auditorium, Cleveland, April 26-30.

*AMERICAN OIL CHEMISTS' SOCIETY*, 39th annual meeting, New Orleans, May 4-6.

*COMMERCIAL CHEMICAL DEVELOPMENT ASSOCIATION*, annual meeting, Roosevelt Hotel, N. Y., March 9-10.

*DRUG, CHEMICAL AND ALLIED TRADES SECTION, N. Y. BOARD OF TRADE*, 22nd annual dinner, Waldorf-Astoria, N. Y., March 11.

*NATIONAL ASSOCIATION OF CORROSION ENGINEERS*, 4th annual conference and exhibition, Jefferson Hotel, St. Louis, April 5-8.

*NATIONAL PETROLEUM ASSOCIATION*, Cleveland Hotel, Cleveland, April 21-33.

*SOCIETY OF THE PLASTICS INDUSTRY*, second national plastics exposition, Coliseum, Chicago, May 6-10.

### *Japanese Technical Publications Made Available*

Several hundred paper bound journals representing a major portion of the issues of twelve different Japanese scientific research publications which appeared during the recent war have been received at Carnegie Institute of Technology, and are now being catalogued.

The Carnegie Tech library is said to be the only one in the country, except for two government libraries in Washing-

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ton, D. C., to have in its possession Japanese scientific publications issued since Pearl Harbor. All of the material at Tech will be available on loan to scientists and students upon request.

About one-half of the material is printed in Japanese. The remainder is in English.

## COMPANIES

The Du Pont Co. is expanding facilities at its Carney's Point, N. J., works for the production of sodium carboxymethyl cellulose. Greatest emphasis will be placed on the production of technical grades of Sodium CMC.

Standard Oil Co. (New Jersey) will dedicate two new research laboratories in 1948. A new Esso laboratory building at Baton Rouge, Louisiana, will be ready for occupancy in December, and the first of a group of new buildings at Linden, New Jersey, for Standard Oil Development Co., central research affiliate, will be completed next spring.

Witco Hydrocarbon Corp. has been organized to process 15 million cubic feet of natural gas per day from the Barnhart pool in Reagan County, Texas.

Two plants are to be constructed. The gasoline plant will produce approximately 2,000 barrels of gasoline, butane, and propane per day. The residual gas will be burned in the second plant to make channel carbon black which will be marketed by the Witco Chemical Co.

The Du Pont Co. has signed a long-term lease of ilmenite-bearing lands with the State of Florida. This will end the company's dependence upon foreign sources.


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### *U. S. Stoneware Names Clark*

***David M. Clark, named research chemist for the Research and Development Laboratories, U. S. Stoneware Co. Until recently, he was with Firestone Laboratories as a research chemist in plastic development.***

Commercialores, Inc., a concern which was formed to develop a kyanite deposit near Clover, York County, S. C., expects to be in operation shortly. The deposit is actually at Henry's Knob, three miles west of Clover, where the company has leased the entire property.

A new two-story building for increasing the finishing and packaging facilities for penicillin and streptomycin will be erected by Merck & Co., Inc., manufacturing chemists. The $400,000 unit will be an annex to the present Sterile Techniques Building which started operations 18 months ago.

The Glidden Co. has placed a contract with Blaw-Knox Co. for equipment and engineering to be used in modernizing its Cleveland plant. The amount of the Blaw-Knox contract is in the neighborhood of $100,000.

Chas. Pfizer & Co., Inc., has executed a 20 year lease agreement with the U. S. Government covering the Vigo plant, Terre Haute, Indiana, based on negotiations between the Pfizer Co. and the corps of engineers, U. S. Army. The lease is effective immediately and possession of the plant has been formally transferred. It is the company's intention to utilize the Vigo plant for the production of antibiotics, such as penicillin and streptomycin, as well as for the manufacture of certain fine chemicals.

The Wheatland Tube Co. has organized the Maneely Chemical Co. as an affiliate unit to scientifically dispose of its waste materials. Plant construction began in January. Production is scheduled for the latter part of the year. Officers are: E. F. Maneely, president; M. K. Maneely, vice-president; and Charles Eaton, secretary.

Arthur S. LaPine & Co., Chicago, has leased 15,000 square feet in the 400 North Rush Street Building. This is in addition to present quarters.

A bulk chemical distributing department has been established in the Chicago

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## SPECIFICATIONS

| | Max. | Min. | Typical Analysis |
|---|---|---|---|
| Melting Point | | | |
| Drop Method | | 175F | 190F |
| ASTM Ring & Ball | | 71C | 79C |
| Acid Number | 125 | 90 | 105 |
| Color | | Dark | Dark |
| Gasoline Insoluble | 80% | 50% | 70% |

## PROPERTIES

Unsaponifiable Matter: Approximately 20%.
Saponification Number: Approximately 140.
Toluene Insoluble: Approximately 1.0%.
Ash: Approximately 0.1%.

## USES

CROSBY BEREZ is used in paper size, asphalt emulsions, lamp base cements, adhesives, varnish, ester gums, linoleum, thermo-plastics, insulating compounds, box toes, depilatory compounds, insulating boards, synthetic resins and many others.

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division of McKesson & Robbins, Inc., to serve the expanding requirements of industrial and pharmaceutical concerns in this trading area. The new department recently began operations. Stocks of basic chemical manufacturers are carried in the McKesson warehouse. These products are supplied for immediate shipment.

### *Monsanto Names Marple*

*Howard A. Marple, appointed to the recently created post of director of advertising, Monsanto Chemical Co. His headquarters are at the company's offices in St. Louis.*

An award of $1,000 and a medallion for outstanding achievement in analytical chemistry has been established by C. G. Fisher, president of the FISHER SCIENTIFIC CO., Pittsburgh, Pa.

The new prize, which will be known as the Fisher Award in Analytical Chemistry, was founded to recognize and encourage important contributions to the science of analytical chemistry, pure or applied, which are made in the United States or Canada.

INTERNATIONAL MINERALS & CHEMICAL CORP. plans construction of a new refinery at Carlsbad, New Mexico, for the production of chemical grade muriate of potash and improved grade of potassium sulphate.

Coincident with the construction of the new plant, refinements in the present plant facilities will be made which will result in improved recoveries and increased capacity for existing grades of potash salts.

CARBIDE AND CARBON CHEMICALS CORP. has opened a new sales office in Houston, Texas. Paul J. Doyle, Jr., has been appointed to take charge of the unit.

A new research group has been organized in Detroit for the purpose of furnishing Detroit industries with an advanced type of testing and development service. It hopes to supply broad research service for all industries of the area. Nucleus of the organization is the DETROIT TESTING LABORATORY. Douglas Dow has been elected president.

ARTHUR C. TRASK CO. has been appointed exclusive agent in the United States and Canada for the sale of chestnut extract and bludtan, produced by the CHAMPION PAPER AND FIBRE CO., Canton, North Carolina.

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### *Bollaert to Manage Dicalite Division*

***Armand R. Bollaert, named general manager of the Dicalite Division of Greak Lakes Carbon Corp. For five years technical director of the Dicalite Division, he rejoins the organization after about a year's absence.***

## CANADA

### *Plans Drafted for Maritime Superphosphates*

Canada's Maritime provinces have for many years been largely agricultural, have had little success in developing an industrial economy. Recently, however, several chemical enterprises have been formed in these eastern provinces—notably a project to produce barytes and another to yield common salt.

This month, however, plans were drafted for a third enterprise—a $4 million sulfuric acid and superphosphate unit. Head of the company is F. W. Pirie (former premier of New Brunswick, one of the major Canadian exporters of potatoes, and owner of Canada's largest potato starch plant). A site has been acquired near Hillsborough, N. B., and plant construction is scheduled to begin within the next few months.

The bulk of the superphosphate produced will be marketed in the Maritimes.

### *Chemical Imports at Robust Level*

Canada has long ranked as the United States' number one chemical customer, and, from present indications, Canada's imports of chemicals during the past year may exceed former tonnages. Although complete 1947 figures have not as yet been compiled, Canadian imports for the first nine months of the year amounted to $84 million—up $16 million over the 1946 valuations. Fertilizers accounted for 25 per cent of the total, up $1 million over the previous year.

# PERSONNEL

### *Company Officers*

JOHN T. COX, JR., has been appointed deputy director of the Office of Rubber Reserve, Reconstruction Finance Corp., Washington, D. C. He was formerly production manager of Rubber Reserve and a member of the technical staff of Firestone Tire and Rubber Co.

THE DARCO CORP. has appointed LOUIS M. GILL as company general manager, and EDGAR W. HARRIS as director of sales. Mr. Gill first joined the company in 1923 as a salesman.

PERCY E. LANDOLT has been elected a director and executive vice-president of Lithium Corp. of America, Inc., and its subsidiary, Metalloy Corporation of Minneapolis, Minnesota.

ROBERT TAYLOR BALDWIN, New York, will retire as treasurer of the American Chemical Society on December 31 after sixteen years of service in this post. He will continue as chairman of the society's Finance Committee.

### *Production*

L. W. PIESTER has joined the Columbia Chemical Division of Pittsburgh Plate Glass Co. as a chemical engineer in the development department at the firm's Natrium, West Virginia plant. He was formerly associated with Corn Products Refining Co.

PHILIP H. ZUIDERHOEK has been named factory manager of the Tuscaloosa, Alabama, plant of The B. F. Goodrich Co.

ELWOOD M. PROCTOR has been appointed manager of the Bemis Bro. Bag Co. plant in Seattle, Washington. He replaces E. J. GREGG, who died recently.

HERCULES POWDER CO. has appointed L. C. LEBRON assistant manager of its explosives department's contractors division in Wilmington, Delaware.

### *Sales*

WALTER G. ANDREWS has been appointed director of special oil sales of Archer-Daniels-Midland Co.

EARL W. DILG has been appointed district manager of The Patterson Foundry & Machine Co., East Liverpool, Ohio, with headquarters at the Cincinnati office of the company. He was formerly chief engineer and sales manager of International Engineering, Inc., Dayton, Ohio.

DAVID H. DAWSON, director of sales of the pigment department of the Du Pont Co., was awarded the honorary degree of Doctor of Engineering by the Drexel Institute of Technology at the institution's Founder's Day convocation in December.

TOM K. SMITH, JR., has been named assistant branch manager of the phosphate division, Monsanto Chemical Co. He will be in charge of the Cincinnati branch of the division's Detroit office.

JULIUS HYMAN & CO. has appointed E. H. COE as entomologist and technical representative. He will work out of the company's San Francisco headquarters.


**MULTIWAX** is used . . .

- For paper laminating and impregnating
- For rubber processing
- As an ingredient in sizing, waterproofing and finishing compounds
- As a protective coating for cable, metal parts, electrical equipment, food products
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Strontium Peroxide (Salt Free)
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Barium Hydrate
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Strontium Oxalate
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# CHEMICAL SPECIALTIES

*A department devoted to news of the chemical specialties field. Descriptions of new specialty products will be found in the New Products & Processes department.*

## *New Test May Aid Waterproofers' Research*

A new test for the waterproofness of leather, developed in the leather laboratory of the National Bureau of Standards, subjects the leather to conditions which more nearly simulate actual use than former methods. Methods that have been previously used include measurements of the amount of water absorbed, the pressure required to force water through the leather, and the amount of water passing through the leather under a given pressure. None of these, however, is a direct measure of the waterproofness of leather and leather goods such as shoes that are ordinarily subjected to high pressures of water or to immersion for any considerable length of time. Moreover, certain indications revealed by these tests do not agree with actual practice.

In the new test, leather specimens are continuously flexed by a specially designed machine while covered with water. The time, or the number of cycles required for water to penetrate a specimen is taken as the measure of its waterproofness. A slight variation of the test, the addition of dyes to the water, has permitted the course of the water to be traced, thus revealing the mechanism of water penetration. This is seen to occur through hair follicles at points of stress along the minute creases formed as the leather is flexed.

A large number of commercial shoe-upper leathers have been tested by the new method, but waterproofing agents tested by the Bureau have been found to have little effect in waterproofing leather. Among those tested have been several of the new water-repellent materials whose application to shoe upper leather generally results in slightly reducing rather than improving the water resistance. However, some of these materials are effective for preserving the leather in storage and in service, although no material has shown promise in waterproofing.

## *Fager Joins Petroleum Specialties*

***Oscar H. Fager, named general manager of Petroleum Specialties Co. He was formerly with the Shell Petroleum Co. as department manager of the Special Products Division.***

## *Introduce New Carbamate-Based Fungicide*

The Du Pont Co. is now producing a new multi-purpose fungicide which not only controls many diseases, but can also be mixed with DDT and other insecticides. Named "Parzate," it contains 65 per cent zinc ethylene bis dithiocarbamate, 15.4 per cent of which is expressed as metallic zinc.

As compounded, the fungicide has natural adhesive properties on plants, so that under ordinary circumstances it is not necessary or desirable to add sticking or wetting agents. Used as a dust, it mixes with talc, pyrophyllite, or other suitable non-alkaline diluents. It is compatible with such insecticides as DDT, rotenone, pyrethrum, nicotine, and the arsenicals, and with other fungicides except coppers.

It is recommended to control leaf blight diseases of celery; downy mildew and other leaf diseases of cucumbers, cantaloupes, and other cucurbits; rust and anthracnose of beans and downy mildews of spinach and beets.

## *Fluresit Markets Unique Mortar Sealant*

A novel mortar sealant, especially formulated for use on glass block, has been developed recently by the American Fluresit Co., Cincinnati.

The sealant, trademarked Klee, is said to overcome the shortcomings of conventional mortars, because, since glass blocks are not porous, mortars shrink, do not form a good mechanical bond. The sealant can be used to coat exterior mortar joints to form a tight, flexible coating.

As compounded, it is plastic-like in consistency, and can be applied either with a caulking gun or thinned with solvents for brush application. It is prepared in several colors, including white, and is packaged in quart and gallon containers.

## *Approve Flame Resistance of Vinyl Resins*

The Bakelite Corp. recently received the approval of the New York Board of Standards and Appeals re the flame resistant qualities of two Vinylite products.

One Type VU-5935, which is a flexible sheeting containing the resin, dioctyl phthalate and antimony oxide, is listed as "melting or fusing when contacted with open flame but not flashing, flaming or glowing." The other, Type RCL a 70 per cent resin, 30 per cent plasticizer composition, is sold to Blanchard Deco-


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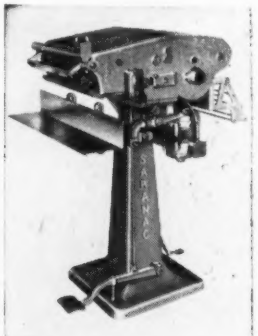

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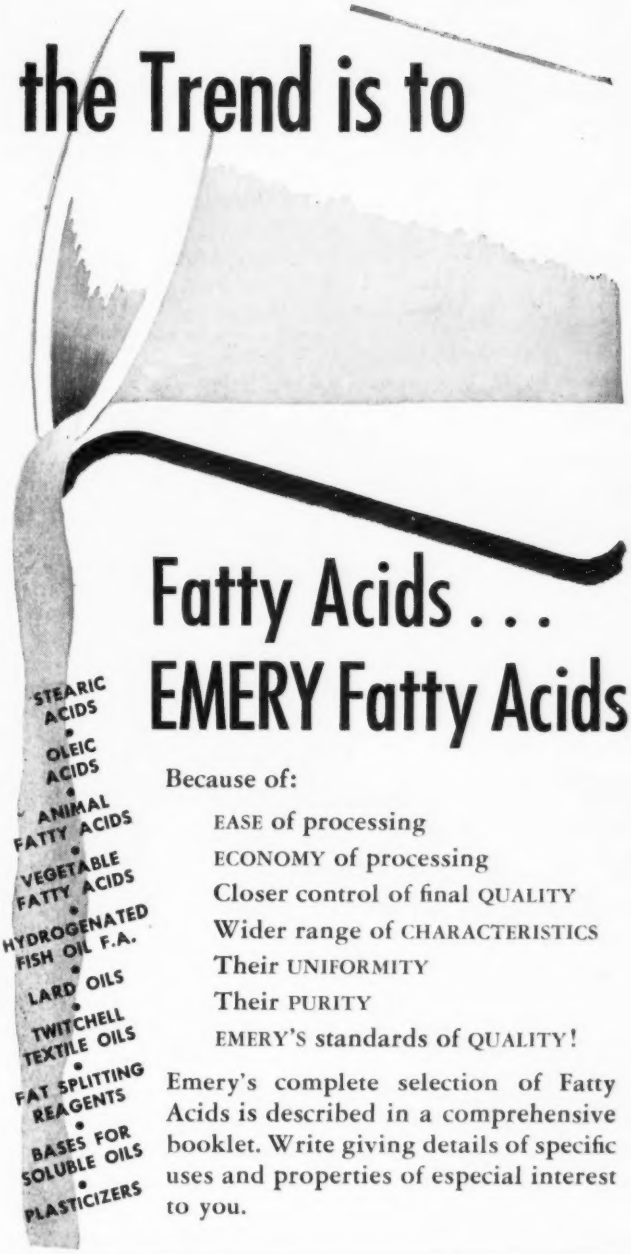

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Plastics, Inc., which color coats one side and markets the finished product for use as a decorative wall covering.

When bonded to plaster, cement, metal, treated plywood, etc., by means of a fire-resistive adhesive manufactured by U. S. Plywood Corp., it too is categorized as flame-resistant. The adhesive, incidentally, is basically a synthetic rubber-polyvinyl alcohol resin composition.

### *Plan Tube Packaging Of Shampoo*

Lennen & Mitchell, Inc., makers of Lustre-Creme shampoo, is completing plans for a broader marketing of their specialty product.

Within the near future the company will package the shampoo in both tube and jars. Although the present $1.00 (4 oz.) jar will remain the major item, smaller 49c and 25c sizes will be promoted as companion items.

### *Sulfamate Suggested for Cellulose Treatment*

Methods for producing flame-resistant, transparent regenerated cellulose films (E. G. Cellophane) with markedly increased durability are described by W. A. Hoffman in U. S. patent 2,422,730. After the series of purifying, bleaching, and washing operations, the regenerated cellulose sheets are passed through a bath containing the following ingredients dissolved in water:

| | |
|---|---|
| Ammonium sulfamate | 12.5 per cent |
| Glycerine | 12.5 per cent |
| Formalin (37% formaldehyde) | 5.4 per cent |

After impregnation of the sheet, the excess solution is removed and the film dried.

### *More Potent Insecticides May Be Needed*

A strain of DDT-resistant houseflies, requiring nearly twice as much of the chemical to kill them as ordinary flies, has been developed for experimental purposes by entomologists of the U. S. Department of Agriculture's Bureau of Entomology and Plant Quarantine laboratory at Orlando, Fla. The scientists there are investigating the effect of periodic applications of DDT to successive generations of houseflies to see what effect the chemical might have on these insects in future years.

The entomologists find that these flies can pass along their ability to resist DDT to their offspring. Each successive generation of the more hardy breed then require increasingly greater amounts of the chemical to kill them. This fact became obvious to the scientists in as early as the third generation.

These flies also resist the effect of other insecticides in addition to DDT. Chlorodane and chlorinated camphene, two of the newly-developed highly effective insecticidal chemicals, and certain thiocyanate compounds as well as rotenone, and pyrethrum, which are old standby insecticides, fail to kill these resistant flies in doses that usually kill normal houseflies.

No such DDT-resistant strains of houseflies are known to occur in nature. It has been reported, however, that houseflies are becoming more difficult to kill with recommended applications of DDT in several parts of the United States and in some foreign countries.

### *Archer-Daniels-Midland Appoints Platt*

*Walter F. Platt, new assistant vice-president in charge of eastern sales for the Archer-Daniels-Midland Co. He has been associated with the company since 1928.*

### *Describe Stripping Lacquer Formulation*

U. S. Patent 2,421,001, granted to H. K. Ash, describes the use of a combination of alkyd resin and cellulose aceto-propionate in the production of an easy-stripping lacquer, which is used as a protective coating for metal surfaces.

Thus, a stripping lacquer which will deposit a permanently strippable film at least 1 mil. thick in a single spray application is made from:

| | |
|---|---|
| Cellulose aceto-propionate | 7.35 parts |
| Alkyd resin | 7.35 parts |
| Butyl acetate | 45.00 parts |
| Ethyl acetate | 35.30 parts |
| Hydroxyethyl acetate | 5.00 parts |

### *Du Pont Forms Veterinary Unit*

The Grasselli Chemicals Dept. of the Du Pont Co. has formed a Veterinary Chemicals Division to handle the manufacture and sale of veterinary chemicals.

Walter H. Salzenberg, who has been ssistant technical director of the department since 1945, has been appointed manager of the new division.

The businesses formerly conducted by Winthrop Chemical Company, Inc. and Frederick Stearns & Company are now owned by Winthrop-Stearns Inc.

KESSCO PRODUCTS

CHEMICAL SPECIALTIES

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- **HYDRAZINE BASE** 93-95%
- **HYDRAZINE HYDRATE** 85%; 100%
- **HYDRAZINE SULFATE** Commercial and C.P.

  Use: Manufacture of intermediates for dyes and pharmaceuticals. Hydrazine Base has solvent properties similar to liquid ammonia.

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- **SEMICARBAZIDE HYDROCHLORIDE** Commercial and C.P.

  Use: Isolation of ketones and aldehydes, forming well-defined crystalline compounds.

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- **PARA DIAZODIMETHYLANILINE**
- **PARA DIAZODIETHYLANILINE**

  Use: The stabilized salts are used in light-sensitive diazo-type coatings.

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# CHEMICAL MARKETS

## *Ample Insecticide Supply in Offing*

With the exception of nicotine and arsenic, supplies of insecticides will be adequate to meet total demand during 1948, in the opinion of the Department of Commerce. At the moment, nicotine output lags behind consumer needs and there is little prospect of anything more than a slight increase being realized this year. However, with hexaethyl tetraphosphate and tetraethyl pyrophosphate moving into production status, and in view of the fact that both are effective against aphids and mites, they may well serve to alleviate the stringent position of nicotine sulfate.

Imports of white arsenic reached 21 million pounds in the first nine months of last year. However, a goodly proportion of this poundage has been absorbed by glass makers, has not been channelled to insecticide compounders.

Copper sulfate, although temporarily tight, should ease within the next three months. Paradichlorobenzene, long short, will be somewhat more readily available this year. As far as benzene hexachloride is concerned, the peak demand will come in March. Not until then will it be possible to determine if present plant capacity is large enough to meet all calls.

DDT, pyrethrum, rotenone, and most toxicants used in household sprays, are, and will continue to be, plentiful.

Or, in essence, although there is expected to be no tapering in the demand for most insecticides, consumers should be able to count on prompt deliveries.

## *Easing of Plastics in Prospect*

According to present indications, the plastics industry, which has expanded many fold in the past few years, may at long last reach a stature whereby supply and demand will be in reasonable balance during 1948. Most plant facilities which were projected in 1945 and 1946 are now producing, or will be producing by mid-year. Originally, of course, many were scheduled to come in six months ago, but construction bottlenecks have caused delays, and, incidentally, building costs have soared some 30 per cent above original estimates.

Last year supplies of most thermosetting plastics fell far short of total needs. This was particularly true of most molding powders and adhesives. With new plant capacity the odds are that the situation will ease. Nevertheless, a critical shortage of formaldehyde, phenol and urea still obtains.

Generally speaking, thermoplastics appear to be headed for an easier time, with indications that the supply-demand balance will be fairly sound by the second quarter. The most serious bottleneck in this category will be the plasticizer shortage—a shortage which may well persist throughout the year.

There is little reason to believe that the outlook is roseate. Nevertheless, there is real justification for the belief that the worst is past, that this year the billion pound plastics industry will chalk up new records and that consumers will be able to obtain nearly all the raw materials they need.

## *Liquefied Gas Sales at Record Level*

Within the past three years the total sales of the liquefied petroleum gas industry have more than doubled, reaching an estimated total volume in 1947 of 1,845,000,000 gallons. The estimated increase in volume sold in 1947 over 1946 is almost equal to the total sold in 1941.

The estimated increase in the volume of liquefied petroleum gas sold for domestic purposes in 1947 over that sold in 1946 exceeded the industry's total sales for domestic use in 1941. It is estimated that sales for domestic purposes in 1947 will exceed 1,000,000,000 gallons. This is greater than the industry's total sales for all uses in a year as recent as 1944 and it is almost equal to the total volume sold for all purposes two years ago.

Among the highlights: The industrial use of LP-Gas for 1947 is estimated as 285,000,000 gallons, an increase of 11.6 per cent over the consumption for the same use in 1946.

The use of LP-Gas by the chemical industry continues to increase principally for conversion to chemical intermediates.

Much LP-Gas is delivered either in the liquid or gas phase by pipeline from the points of production to chemical plants. It is estimated that 415,000,000 gallons were consumed by the chemical industry in 1947. This represented an increase over 1946 of 34.9 per cent.

## *Idaho Moves up as Phosphate Producer*

Total mine production of phosphate rock in the United States in the first half of 1947, was 4,667,220 long tons. Phosphate rock sold or used in the first half of 1947, 4,638,158 long tons, was more than a million tons greater than in the corresponding period of 1946; the value, $23,986,736, was over ten million dollars greater.

The average value of the phosphate rock sold or used increased nearly a dollar per ton, from $4.24 in the first half of 1946 to

$5.17 in the similar period of 1947, increases being reported in all classes of rock except soft rock from Florida.

In the first half of 1947, phosphate rock was mined in Florida, Tennessee, Idaho, and Montana, and apatite in Virginia. Florida was the leading shipper, as usual, its marketed production increasing to more than four times that of its nearest competitor, Tennessee.

The quantity of Tennessee rock sold or used in the first half of 1947 was greater than in the corresponding period of 1946, and the value was more than half a million dollars greater. Idaho showed a tremendous increase in the quantity of phosphate rock sold or used in the first six months of 1947 over the January-to-June period of 1947, jumping from 109,658 long tons in the first half year of 1946 to 619,926 tons in the same period of 1947. The average value increased from $5.42 to $5.84, and the total value was over six times as great as in the first six months of 1946.

### *Mineral Output Reaches New Peak*

The total value of minerals and mineral products produced in the United States and Alaska in 1947 reached an all-time peak of $12,400,000,000, exceeding the former record of 1946 by 40 per cent. The 1946 figure was $8,859,000,000.

A new high in the physical volume of production also accompanied the increase in dollar value. On the basis of preliminary estimates prepared by the Bureau of Mines, the total quantity of minerals produced was approximately 5 percent over the previous peak output recorded in 1944, and about 13 per cent over the 1946 production.

With industrial demand for soda ash and other salt products so great, salt output in 1947 is estimated at about 15,000,000 short tons—close to the peak of 15,717,000 tons attained in 1944. Domestic demand for native sulfur also was very high in 1947 and foreign sales were the greatest in history; production reached a record total of 4,825,000 long tons. Output of pyrites, the other major source of sulfur, increased moderately to about 825,000 long tons.

Production of barite totaled about 720,000 short tons. United States provides most of the world's boron minerals; in 1947 production in this country was estimated at 460,000 short tons—a new record.

Shipments of fluorspar established a peacetime record approximating 330,000 short tons. Substantial tonnages of lithium minerals were consumed during the war but output in 1947 was at a low level. However, the peacetime markets for lithium compounds are expanding and output was greater than in 1946.

Owing to the severe shortage of soda ash, output from natural deposits increased substantially in 1947.

### *Casein Registers Abnormal Drop*

Production of dry casein in November is estimated at 865,000 pounds, dropping below the same month in 1946 for the first time.

It contrasted with a contraseasonal gain of 26 per cent in 1946 and exceeded the 1941-45 average decline of 31 per cent.

Production for the first 11 months of 1947 amounted to 30,448,000 pounds, 92 per cent greater than in same period of 1946 and 16 per cent greater than the five-year average.

### *Rubber Processors Consume Record Tonnage*

Last year's automotive tire production and shipments will break all previous records. The eleven months' figures released recently by The Rubber Manufacturers Association show that by November 30, 1947, the industry had produced 71,168,058 passenger casings and 16,330,552 truck and bus casings, as against 60,371,664 and 14,415,357 respectively for the same period in 1946.

In the consumption of rubber, the first eleven months of 1947 virtually equalled the total annual consumption for the best previous year in the history of the industry.

In 1946, the industry used what was then an all time record 1,039,296 long tons of new rubber.


WOBURN dependable PRODUCTS

MANY new and important advancements have been made in the use and application of Fatty Acids. Woburn has for many years been recognized for its leadership in this field. This has been achieved through our close relations with users of organic chemicals and those who supply us with materials from which our products are manufactured.

In keeping with this spirit of cooperation, we have prepared a series of technical bulletins providing factual information describing the properties, uses and similar vital data concerning fatty acids, synthetic drying oils and other important organic chemicals. We will be happy to send you a complete set of these informative pamphlets. Address request on your letterhead, to the attention of our Public Relations Department.

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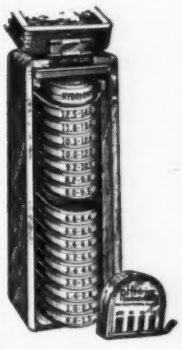

This new variety of sensitive pH papers offers a sharp color change within 0.25 pH unit of almost any point of interest from pH 0 to pH 14.

Hydrion test papers are so simple, so accurate, now so nearly universal, that this Set H-20 *should be in the hands of every worker making pH measurements in laboratory or plant.*

*Price: Set H-20, $20*
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textile chemicals industrial specialties
*Quaternary Ammonium Compounds*

# CURRENT PRICES

Chemical prices quoted are of American manufacturers for spot New York, immediate shipment, unless otherwise specified. Products sold f.o.b. works are specified as such. Import chemicals are so designated.

Oils are quoted spot New York, ex-dock. Quotations f.o.b. mills, or for spot goods at the Pacific Coast are so designated.

Raw materials are quoted New York, f.o.b., or ex-dock. Materials sold f.o.b. works or delivered are so designated.

The current range is not "bid and asked," but are prices from different sellers, based on varying grades or quantities or both.

*Purchasing Power of the Dollar: 1926 Average—$1.00*
*January, 1946, $0.767 January, 1947, $0.601*
*January, 1948, $0.581*

| | Current | | 1948 | | 1947 | |
|---|---|---|---|---|---|---|
| | Low | High | Low | High | Low | High |
| Acetaldehyde, 99%, drs wks..lb. | .11 | .12 | .11 | .12 | .11 | .15 |
| Acetic Anhydride, drs, c.l., frt. all. E.....lb. | .13 | .14½ | .13 | .14½ | .11½ | .14½ |
| Acetone, tks, delv.....lb. | .07 | .09 | .07 | .09 | .07 | .09 |
| ACIDS | | | | | | |
| Acetic, 28% bbls.....100 lbs. | 3.78 | 4.08 | 3.78 | 4.08 | 3.38 | 4.08 |
| Glacial, synthetic, C. P., drs, wks.....100 lbs. | 13.50 | 14.00 | 13.50 | 14.00 | 13.50 | 14.00 |
| Acetylsalicylic, Standard USP.....lb. | .45 | .59 | .45 | .59 | .45 | .59 |
| Benzoic, tech, bbls.....lb. | .43 | .47 | .43 | .47 | .43 | .47 |
| USP, bbls, 4,000 lbs. up....lb. | .... | .54 | .... | .54 | .... | .54 |
| Boric tech, bbls, c-l, frt. split.....tons | .... | 124.00 | .... | 124.00 | .... | 124.00 |
| Chlorosulfonic, drs, wks....lb. | .03 | .04½ | .03 | .04½ | .03 | .04½ |
| Citric, USP, crys, gran, bbls.....lb. *b* | .22 | .23 | .22 | .23 | .20 | .23 |
| Cresylic 50%, 210-215° low boil 50%, drs, wks, frt, equal.....gal. | 1.26 | 1.48 | 1.26 | 1.48 | 1.01 | 1.26 |
| Formic, 85%-90% cbys.....lb. | .12 | .14½ | .12 | .14½ | .10 | .14½ |
| Hydrofluoric, 30% rubber, drs.....lbs. | .08 | .09 | .08 | .09 | .08 | .09 |
| Lactic, 22%, bbls, c.l., wks, 100.....lb. | .... | 4.40 | .... | 4.40 | .... | 4.40 |
| 44%, light, bbls, wks.....lb. | .815 | .855 | .815 | .855 | .073 | .855 |
| Maleic, Anhydride, drs.....lb. | .25 | .26 | .25 | .26 | .25 | .26 |
| Muriatic 18° cbys.....100 lbs. | 1.50 | 2.90 | 1.50 | 2.90 | 1.50 | 2.90 |
| 20° cbys, c-l, wks....100 lbs. | 1.85 | 2.00 | 1.85 | 2.00 | 1.85 | 2.00 |
| 22° cbys, c-l, wks....100 lbs. | 2.35 | 2.50 | 2.35 | 2.50 | 2.35 | 2.50 |
| Nitric, 36°, cbys, wks..100 lbs. *c* | 5.00 | 6.30 | 5.00 | 6.30 | 5.00 | 6.30 |
| 38°, c-l, cbys, wks...100 lbs. *c* | 2.35 | 5.50 | 2.35 | 5.50 | .... | 5.50 |
| 40°, c-l, cbys, wks...100 lbs. *c* | 6.00 | 6.50 | 6.00 | 6.50 | .... | 6.50 |
| 42°, c-l, cbys, wks...100 lbs. *c* | 6.50 | 7.00 | 6.50 | 7.00 | .... | 7.00 |
| Oxalic, bbls, wks.....lb. | .13 | .14 | .13 | .14 | .11¾ | .14 |
| Phosphoric, 100 lb. cbys, USP.....lb. | .10½ | .13 | .10½ | .13 | .10½ | .13 |
| Salicyclic tech, bbls.....lb. | .31 | .38 | .31 | .38 | .26 | .42 |
| Sulfuric, 60°, tks, wks.....ton | 12.25 | 13.50 | 12.25 | 13.50 | .... | 13.50 |
| 66°, tks, wks.....ton | 15.00 | 17.50 | 15.00 | 17.50 | .... | 17.50 |
| Fuming 20% tks, wks....ton | 19.50 | 20.50 | 19.50 | 20.50 | .... | 20.50 |
| Tartaric, USP, bbls.....lb. | .45½ | .50 | .45½ | .50 | .49½ | .55 |
| Alcohol, Amyl (from Pentane) tks, delv.....lb. | .... | .25 | .... | .25 | .... | .25 |
| Butyl, normal, syn, tks...lb. | .... | .17 | .... | .17 | .... | .17 |
| Denatured, CD, proprietary solvent.....gal. *d* | 1.00½ | 1.03 | 1.00½ | 1.03 | 1.00½ | 1.03 |
| Ethyl, 190 proof tks.....gal. | 18.04 | 18.13 | 18.04 | 18.13 | 18.04 | 18.08 |
| Isobutyl, ref'd, drs.....lb. | .... | .13 | .... | .13 | .... | .13 |
| Isopropyl ref'd, 91% dms.....gal. | .44 | .50½ | .44 | .50½ | .41 | .50½ |
| Alum, ammonia, lump, bbls, wks.....100 lbs. | .... | 4.25 | .... | 4.25 | .... | 4.25 |
| Aluminum, 98.99%....100 lbs. | 15.00 | 16.00 | 15.00 | 16.00 | 15.00 | 16.00 |
| Chloride anhyd, l.c.l. wks..lb. | .... | .10¼ | .... | .10¼ | .... | .10¼ |
| Hydrate, light, bgs.....lb. | .... | .17 | .... | .17 | .... | .17 |
| Sulfate, com'l. bgs, wks, c-l.....100 lbs. | 1.15 | 1.30 | 1.15 | 1.30 | 1.15 | 1.30 |
| Sulfate, iron-free, bgs, wks .....100 lbs. | 1.95 | 2.25 | 1.95 | 2.25 | 1.75 | 2.50 |
| Ammonia anhyd. cyl.....lb. | .16 | .... | .16 | .... | .14½ | .20 |
| Ammonia, anhyd, fert, tank cars, wks, frt, equalized...ton | .... | 59.00 | .... | 59.00 | .... | 59.00 |
| Ammonium Carbonate, USP, lumps, drs.....lb. | .08¼ | .19 | .08¼ | .19 | .08¼ | .19 |
| Chloride, USP bbls, drms, kgs.....lb. | .13 | .15 | .13 | .15 | .13 | .15 |
| Nitrate, tech, bgs, wks....lb. | .0435 | .0450 | .0435 | .0450 | .0435 | .0450 |
| Oxalate pure, grn, bbls....lb. | .23 | .29 | .23 | .29 | .23 | .29 |
| Perchlorate, kgs.....lb. | .25 | .... | .25 | .... | .24 | .25 |
| Phosphate, dibasic tech, bgs.....lb. | .07 | .07¾ | .07 | .07¾ | .07 | .07¾ |
| Stearate, anyd, drs.....lb. | .... | .34 | .... | .34 | .... | .34 |
| Sulfate, drs, bulk.....ton | 30.00 | 40.00 | 30.00 | 40.00 | 30.00 | 38.00 |

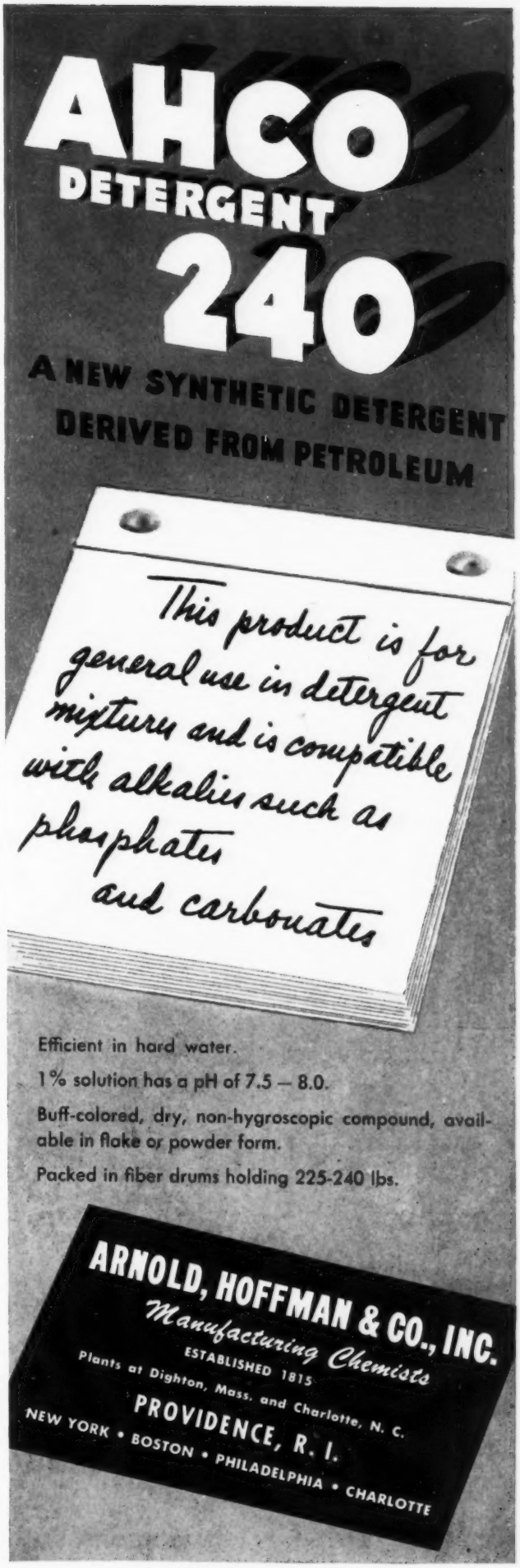
USP $25 higher; Prices are f.o.b. N. Y., Chicago, St. Louis, deliveries ½c higher than NYC prices. *a* Powdered boric acid $5 a ton higher; *b* Powdered citric acid is ½c higher; *c* Yellow grades 25c per 100 lbs. less in each case; *d* Prices given are Eastern schedule.

## *Current Prices*

## Amyl Acetate Gums

| | Current Low | Current High | 1948 Low | 1948 High | 1947 Low | 1947 High |
|---|---|---|---|---|---|---|
| Amyl Acetate (from pentane) tks, delv lb. | .21 | .24 | .21 | .24 | .21 | .24 |
| Aniline, Oil, drs lb. | .13 | .14 | .13 | .14 | .12 | .14 |
| Anthraquinone, sub, bbls lb. | .... | .70 | .... | .70 | .... | .70 |
| Antimony Oxide, bgs lb. | .26 | .27½ | .26 | .27½ | .21 | .31 |
| Arsenic, whl, bbls, powd lb. | .06 | .08 | .06 | .08 | .05 | .08 |
| Barium Carbonate precip, wks, bgs ton | 67.50 | 82.00 | 67.50 | 82.00 | 60.00 | 82.00 |
| Chloride, tech, cryst, bgs, zone 1 ton | 85.00 | 95.00 | 85.00 | 95.00 | 73.00 | 95.00 |
| Barytes, floated, paper bgs ton | no prices | | no prices | | .... | 41.95 |
| Bauxite, bulk mines ton | 8.50 | 10.00 | 8.50 | 10.00 | 7.00 | 10.00 |
| Benzaldehyde, tech, cbys, drs lb. | .45 | .55 | .45 | .55 | .45 | .55 |
| Benzene (Benzol), 90%, tks, frt all'd gal. | .19 | .21 | .19 | .21 | .19 | .21 |
| Benzyl Chloride, cbys lb. | .20 | .28 | .20 | .28 | .20 | .28 |
| Beta-Naphthol, tech, bbls, wks lb. | .23 | .29 | .23 | .29 | .21 | .29 |
| Bismuth metal, ton lots lb. | .... | 2.00 | .... | 2.00 | .... | 2.00 |
| Blanc Fixe, 66⅔% Pulp, bbls, wks ton | 55.00 | 60.00 | 55.00 | 60.00 | 40.00 | 60.00 |
| Bleaching Powder, wks, 100 lbs. | 2.75 | 3.75 | 2.75 | 3.75 | 2.50 | 3.75 |
| Borax, tech, c-l, bgs ton | 53.50 | 56.00 | 53.50 | 56.00 | 45.00 | 56.00 |
| Bordeaux Mixture, bgs lb. | .15 | .23 | .15 | .23 | .11 | .23 |
| Bromine, cases lb. | .21 | .23 | .21 | .23 | .21 | .23 |
| Butyl, acetate, norm, drs lb. | .30½ | .36½ | .30½ | .36½ | .26 | .33½ |
| Cadmium Metal lb. | 1.75 | 1.80 | 1.75 | 1.80 | .... | 1.80 |
| Calcium, Acetate, bgs 100 lbs. | 3.00 | 4.00 | 3.00 | 4.00 | 3.00 | 4.00 |
| Carbide, drs ton | 50.00 | 90.00 | 50.00 | 90.00 | 50.00 | 90.00 |
| Chloride, flake, bgs, c-l ton | 21.50 | 38.00 | 21.50 | 38.00 | 18.50 | 38.00 |
| Solid, 73-75% drs, c-l ton | 20.00 | 37.50 | 20.00 | 37.50 | 18.00 | 37.50 |
| Gluconate, USP, bbls lb. | .58 | .65 | .58 | .65 | .57 | .65 |
| Phosphate tri, bbls, c-l lb. | 6.50 | 6.80 | 6.50 | 6.80 | 6.50 | 6.80 |
| Camphor, USP, gran, powd, bbls, 2,000-lb. lots lb. | .66 | .78 | .66 | .78 | .75 | .82 |
| Carbon Bisulfide, 55-gal. drs lb. | .05 | .05¾ | .05 | .05¾ | .05 | .05¾ |
| Dioxide, cyl lb. | .06 | .08 | .06 | .08 | .06 | .08 |
| Tetrachloride, Zone 1, 52½ gal. drs lb. | .06½ | .07 | .06½ | .07 | .06 | .07 |
| Casein, Acid Precip, bgs, 10,000 lbs. or more lb. | .30 | .35 | .30 | .35 | .26 | .35 |
| Chlorine, cyls, lcl, wks, contract lb. | .09 | .15½ | .09 | .15½ | .08¾ | .10½ |
| Liq, tk, wks, contract 100 lbs. | .... | 2.25 | .... | 2.25 | .... | 2.30 |
| Chloroform, tech, drs lb. | .20 | .23 | .20 | .23 | .20 | .23 |
| Coal tar, wks, crude, dms, c-l, wks dm. | .... | 10.60 | .... | 10.60 | .... | 10.60 |
| Cobalt, Acetate, bbl lb. | .... | .83¾ | .... | .83¾ | .... | .83¾ |
| Oxide, black kgs lb. | 1.275 | 1.80 | 1.275 | 1.80 | .... | 1.30 |
| Copper, metal 100 lbs. | .... | 21.50 | .... | 21.50 | 21.50 | 24.00 |
| Carbonate, 52-54%, bbls lb. | .24 | .26 | .24 | .26 | .19½ | .26½ |
| Sulfate, bgs, wks cryst, 100 lbs. | 7.60 | 8.00 | 7.60 | 8.00 | 7.10 | 8.60 |
| Copperas, bulk, c-l, wks ton | .... | 14.00 | .... | 14.00 | .... | 14.00 |
| Cresol, USP, drs lb. | .14 | .17¼ | .14 | .17¼ | .13¾ | .15¾ |
| Dibutylamine, c-l, drs, wks lb. | .52½ | .76 | .52½ | .76 | .... | .76 |
| Dibutylphthalate, drs lb. | .32 | .38½ | .32 | .38½ | .29 | .38½ |
| Diethylaniline, drs lb. | .... | .48 | .... | .48 | .... | .48 |
| Diethyleneglycol, drs, wks lb. | .14 | .15 | .14 | .15 | .14 | .15 |
| Dimethylaniline, drs, cl., lcl. lb. | .21 | .24¼ | .21 | .24¼ | .20 | .24¼ |
| Dimethylphthalate, drs lb. | .23½ | .24¾ | .23½ | .24¾ | .20 | .24¾ |
| Dinitrobenzene bbls lb. | .... | .16 | .... | .16 | .... | .16 |
| Dinitrochlorobenzene, dms lb. | .14 | .15½ | .14 | .15½ | .14 | .15½ |
| Dinitrophenol, bbls lb. | .... | .22 | .... | .22 | .... | .22 |
| Dinitrotoluene, refd., drs lb. | .... | .18 | .... | .18 | .... | .18 |
| Diphenyl, bbls, lcl, wks lb. | .15 | .20 | .15 | .20 | .15 | .20 |
| Diphenylamine bbls lb. | .... | .25 | .... | .25 | .... | .25 |
| Diphenylguanidine, drs lb. | .35 | .37 | .35 | .37 | .35 | .37 |
| Ethyl Acetate syn. 85-90%, tks, frt. all'd lb. | .09½ | .13½ | .09½ | .13½ | .09½ | .12 |
| Chloride, USP, bbls lb. | .20 | .22 | .20 | .22 | .18 | .22 |
| Ethylene Dichloride, lcl, wks, E. Rockies, drs lb. | .08½ | .09½ | .08½ | .09½ | .08½ | .09½ |
| Glycol, dms, cl lb. | .... | .13½ | .... | .13½ | .... | .12 |
| Fluorspar, No. 1, grd. 95-98% bulk, c-l mines ton | .... | 37.00 | .... | 37.00 | .... | 37.00 |
| Formaldehyde, bbls, cl & lcl lb. | .0645 | .0745 | .0645 | .0745 | .0520 | .0745 |
| Furfural tech, tks lb. | .... | .09½ | .... | .09½ | .... | .13 |
| Fusel Oil, ref'd. drs, dlvd lb. | .26½ | .29½ | .26½ | .29½ | .18½ | .29½ |
| Glauber's Salt, Cryst, bgs, wks 100 lbs. | 1.25 | 1.75 | 1.25 | 1.75 | 1.05 | 1.75 |
| Glycerine dynamite, drs, c-l lb. | .39½ | .40¼ | .39½ | .40¼ | .29½ | .75¾ |
| Crude Saponification, 88% to refiners tks lb. | .23 | .30 | .23 | .30 | .23 | .60 |
| **GUMS** | | | | | | |
| Gum Arabic, amber sorts bgs lb. | .14 | .15 | .14 | .15 | .13¾ | .15 |
| Benzoin, Sumatra, cs lb. | .50 | .60 | .50 | .60 | .50 | 1.00 |
| Copal, Congo No. 1, bgs lb. | .26 | .29 | .26 | .29 | .26 | .29 |
| Copal, East India, chips lb. | no prices | | no prices | | no prices | |
| Macassar DBB, bgs lb. | .24 | .25 | .24 | .25 | .24 | .25 |
| Copal Manila lb. | no prices | | no prices | | .25 | .... |
| Karaya, bbls, bxs, drs lb. | .20 | .51 | .20 | .51 | .20 | .55 |

ABBREVIATIONS—Anhydrous, anhyd; bags, bgs; barrels, bbls; carboys, cbys; carlots, c-l; less than carlots, lcl; drums, drs; kegs, kgs; powdered, powd; refined, ref'd; tanks, tks; works, f.o.b., wks.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240
A NEW SYNTHETIC DETERGENT
DERIVED FROM PETROLEUM
This product is for general use in detergent mixtures and is compatible with alkalies such as phosphates and carbonates
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1% solution has a pH of 7.5 – 8.0.
Buff-colored, dry, non-hygroscopic compound, available in flake or powder form.
Packed in fiber drums holding 225-240 lbs.
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# ACCULUTE

**. . . for rapid, accurate preparation of Volumetric Solutions.**

**. . . Laboratories requiring speed and accuracy are using Acculute with excellent results.**

**ACCULUTE SAVES TIME**—Open the ampoule—transfer the contents to a volumetric flask—dilute to volume (1000 ml)—your volumetric solution is prepared.

**ACCULUTE IS RELIABLE**—Close control of the special manufacturing processes insures uniformity of the product. Acculute does not vary in chemical content—you can depend on it.

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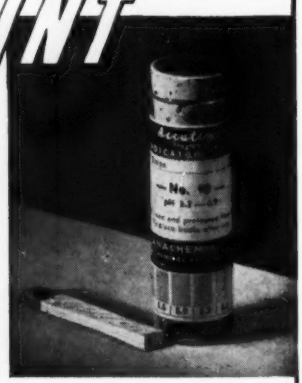
# ACCUTINT

## pH TEST PAPERS

***Simple***

***Rapid***

***Accurate***



Accutint is simple to use—just place a strip of the paper in contact with the substance to be tested and compare the color of the exposed portion with the master colors on the vial.

Accutint is rapid—it gives immediate results—no calculations are necessary—visual color comparison indicates the pH value.

Accutint is accurate—to 1 pH in the wide range paper and to 0.3 pH in the fractional range. Wide range papers are recommended where the pH value is not known to be within the limits of a fractional range paper. Fractional range papers are used for greater accuracy after the range has been determined.

**S-65277 ACCUTINT TEST PAPERS.** Packed in glass vials, each vial contains five pads or 100 strips. Color chart and instructions are included with each vial. Per Vial ..... **$0.65**
Per 72 Vials ..... **10% Discount**

**S-65278 MASTER COLOR CHART.** Illustrates color standards and readings for every pH value in each of the twenty-three wide and fractional ranges. Chart helps in the selection of the most suitable ranges or papers for a specific purpose. Each ..... **$3.25**

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***Michigan Division: 1959 E. Jefferson, Detroit 7, Michigan***

**SARGENT**
SCIENTIFIC LABORATORY SUPPLIES


# *Current Prices*

## Gums
## Saltpeter

| | Current Low | Current High | 1948 Low | 1948 High | 1947 Low | 1947 High |
|---|---|---|---|---|---|---|
| Kauri, N. Y. | | | | | | |
| Superior Pale XXX ..... lb. | no prices | | no prices | | .... | nom. |
| bgs ..... lb. | | .31 | | .31 | .... | .31 |
| Sandarac, cks ..... lb. | .95 | 1.00 | .95 | 1.00 | .85 | 1.00 |
| Tragacanth, No. 1, cases .... lb. | 3.60 | 8.70 | 3.60 | 8.70 | 3.60 | 8.70 |
| No. 3 ..... lb. | 2.00 | 2.50 | 2.00 | 2.50 | 2.00 | 3.45 |
| Yacca, bgs ..... lb. | .06 | .07 | .06 | .07 | .06 | .07 |
| Hydrogen Peroxide, cbys .... lb. | .15½ | .18½ | .15½ | .18½ | .15½ | .18½ |
| Iodine, Resublimed, jars .... lb. | 2.35 | 2.65 | 2.35 | 2.65 | .... | 2.65 |
| Lead Acetate, cryst, bbls .... lb. | .... | .19¼ | .... | .19¼ | .... | .19¼ |
| Arsenate basic, bg, lcl ..... lb. | .22¾ | .23¾ | .22¾ | .23¾ | .... | .23¾ |
| Nitrate, bbls ..... lb. | .17¾ | .18 | .17¾ | .18 | .... | .18 |
| Red, dry, 95% $Pb_3O_4$ | | | | | | |
| bbls ..... lb. | .17½ | .18½ | .17½ | .18½ | .14¼ | .19¼ |
| 97% $Pb_3O_4$, bbls, delv ... lb. | .17½ | .18¾ | .17½ | .18¾ | .15 | .19½ |
| 98% $Pb_3O_4$, bbls, delv ... lb. | .18 | .19 | .18 | .19 | .15¼ | .19¾ |
| White, bbls ..... lb. | .16 | .16¼ | .16 | .16¼ | .13 | .17¾ |
| Basic sulfate, bbls, lcl ... lb. | .15¼ | .15½ | .15¼ | .15½ | .12½ | .15½ |
| Lime, Chem., wks, bulk .... ton | 6.50 | 10.25 | 6.50 | 10.25 | 6.50 | 10.25 |
| Hydrated, f.o.b. wks ..... ton | 8.00 | 12.14 | 8.00 | 12.14 | 8.00 | 12.14 |
| Litharge, coml, delv, bbls ... lb. | .1660 | .17½ | .1660 | .17½ | .13 | .17½ |
| Lithopone, ordi., bgs ..... lb. | .05½ | .06 | .05½ | .06 | .03 | .06 |
| Magnesium Carb, tech, wks .. lb. | .07¼ | .10¾ | .07¼ | .10¾ | .07¼ | .10¾ |
| Chloride flake, bbls, wks | | | | | | |
| c-l ..... ton | .... | 40.00 | .... | 40.00 | .... | 37.00 |
| Manganese Chloride, Anhyd. | | | | | | |
| bbls ..... lb. | .12¾ | .16 | .12¾ | .16 | .14 | .16 |
| Dioxide, Caucasian bgs, | | | | | | |
| lcl ..... ton | 74.75 | 79.75 | 74.75 | 79.75 | 74.75 | 79.75 |
| Methanol, pure, nat, drs .. gal. *l* | .63 | .73 | .63 | .73 | .63 | .73 |
| Synth, drs cl ..... gal. *m* | .34½ | .41½ | .34½ | .41½ | .31 | .41½ |
| Methyl Acetate, tech tks .... lb. | .06 | .07 | .06 | .07 | .06 | .07 |
| C. P. 97-99%, tks, delv .. lb. | .09½ | .10½ | .09½ | .10½ | .09½ | .10½ |
| Chloride Indust., cycl, wks. lb. | .16 | .41 | .16 | .41 | .32 | .41 |
| Ethyl Ketone, tks, frt all'd. lb. | .... | .10 | .... | .10 | .... | .09 |
| Naphtha, Solvent, tks ..... gal. | .... | .28 | .... | .28 | .... | .28 |
| Naphthalene, crude, 74°, wks, | | | | | | |
| tks ..... lb. | .04½ | .05¾ | .04½ | .05¾ | .035 | .083 |
| Nickel Salt, bbls, NY ..... lb. | .14 | .14½ | .14 | .14½ | .14 | .14½ |
| Nitre Cake, blk ..... ton | 20.00 | 24.00 | 20.00 | 24.00 | .... | 24.00 |
| Nitrobenzene, drs, wks ..... lb. | .08½ | .10 | .08½ | .10 | .08 | .09½ |
| Orthoanisidine, bbls ..... lb. | .... | .80 | .... | .80 | .... | .70 |
| Orthochlorophenol, drs ..... lb. | .... | .37 | .... | .37 | .25 | .37 |
| Orthodichlorobenzene, drs ... lb. | .07½ | .10½ | .07½ | .10½ | .07 | .10½ |
| Orthonitrochlorobenzene, | | | | | | |
| wks ..... lb. | .15 | .18 | .15 | .18 | .15 | .18 |
| Orthonitrotoluene, wks, drs .. lb. | .08 | .09 | .08 | .09 | .08 | .09 |
| Paraldehyde, 98%, wks lcl ... lb. | .12½ | .13½ | .12½ | .13½ | .22 | .13½ |
| Chlorophenol, drs ..... lb. | .25 | .29 | .25 | .29 | .24 | .29 |
| Dichlorobenzene, wks ..... lb. | .12½ | .14 | .12½ | .14 | .12½ | .14 |
| Formaldehyde, drs, wks ... lb. | .21 | .23 | .21 | .23 | .... | .22 |
| Nitroaniline, wks, kgs ..... lb. | .41 | .43 | .41 | .43 | .41 | .43 |
| Nitrochlorobenzene, wks, .. lb. | .... | .15 | .... | .15 | .... | .18 |
| Toluenesulfonamide, bbls .. lb. | .... | .70 | .... | .70 | .... | .70 |
| Toluidine, bbls, wks ..... lb. | .44 | .53 | .44 | .53 | .... | .53 |
| Penicillin, ampules per | | | | | | |
| 100,000 units, bulk ..... | .14 | .19 | .14 | .19 | .14 | .38 |
| Pentaerythritol, tech ..... lb. | .32 | .36 | .32 | .36 | .27 | .36 |

### PETROLEUM SOLVENTS AND DILUENTS

| | | | | | | |
|---|---|---|---|---|---|---|
| Lacquer diluents, tks, | | | | | | |
| East Coast ..... gal. | .13 | .16 | .13 | .16 | .... | .14 |
| Naphtha East | | | | | | |
| tks, wks ..... gal. | .11 | .14 | .11 | .14 | .... | .11 |
| Rubber solvents, East, tks, | | | | | | |
| wks ..... gal. | .12½ | .13 | .12½ | .13 | .... | .12 |
| Stoddard Solvents, East, | | | | | | |
| tks, wks ..... gal. | .11½ | .14 | .11½ | .14 | .... | .12 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Phenol, U.S.P., drs ..... lb. | .11¼ | .13¼ | .11¼ | .13¼ | .11¼ | .13¼ |
| Phthalic Anhydride, cl and lcl, | | | | | | |
| wks ..... lb. | .14½ | .20 | .14½ | .20 | .14½ | .17½ |
| Potash, Caustics, 88-92%, | | | | | | |
| wks, sol ..... lb. | .06¾ | .07½ | .06¾ | .07½ | .06¼ | .07½ |
| Flake, 88-92% ..... lb. | .07½ | .08¼ | .07½ | .08¼ | .07 | .08¼ |
| liquid, 45% basis, tks ... lb. | .... | .03½ | .... | .03½ | .... | .03½ |
| drs, wks ..... lb. | .0337½ | .0375 | .0337½ | .0375 | .03¼ | .04 |
| Carbonate hydrated | | | | | | |
| 83-85%, bbls ..... lb. | .05¾ | .06 | .05¾ | .06 | .06 | .05¾ |
| Chlorate crys, kgs, wks ... lb. | .08½ | .09¾ | .08½ | .09¾ | .08½ | .13 |
| Chloride, USP, cryst., bbls. lb. | .21 | .22 | .21 | .22 | .21 | .22 |
| Cyanide, drs, wks ..... lb. | .... | .55 | .... | .55 | .... | .55 |
| Iodide, drs ..... lb. | 1.95 | 1.98 | 1.95 | 1.98 | 1.44 | 1.98 |
| Muriate dom, 60-62-63% | | | | | | |
| $K_2O$ bulk unit-ton ..... | .37½ | .53½ | .37½ | .53½ | .37½ | .53½ |
| Permanganate, USP, wks | | | | | | |
| drs ..... lb. | .22½ | .24 | .22½ | .24 | .20½ | .23 |
| Sulfate, 90%, basis, bgs .. ton | 36.25 | 39.25 | 36.25 | 39.25 | 36.25 | 39.25 |
| Propane, group 3, tks ..... gal. | .03½ | .06¾ | .03½ | .06¾ | .03½ | .06¾ |
| Pyridine, reg., drs ..... lb. | .60 | .69 | .60 | .69 | .55 | .65 |
| R Salt, 250 lb. bbls, wks .... lb. | .61 | .72 | .61 | .72 | .... | .72 |
| Resorcinol, tech. drs, wks .. lb. | .... | .68 | .... | .68 | .64 | .74 |
| Rochelle Salt, cryst ..... lb. | .32½ | .35 | .32½ | .35 | .32½ | .35 |
| Salt Cake, dom, blk wks .... ton | 20.00 | 26.00 | 20.00 | 26.00 | .... | 26.00 |
| Saltpeter, grn, bbls ..... 100 lbs. | 8.00 | 9.50 | 8.00 | 9.50 | 8.20 | 9.50 |

*l* Producers of natural methanol divided into two groups and prices vary for these two divisions; *m* Country is divided into 4 zones, prices varying by zone. Spot price is ½c higher.

## *Current Prices*

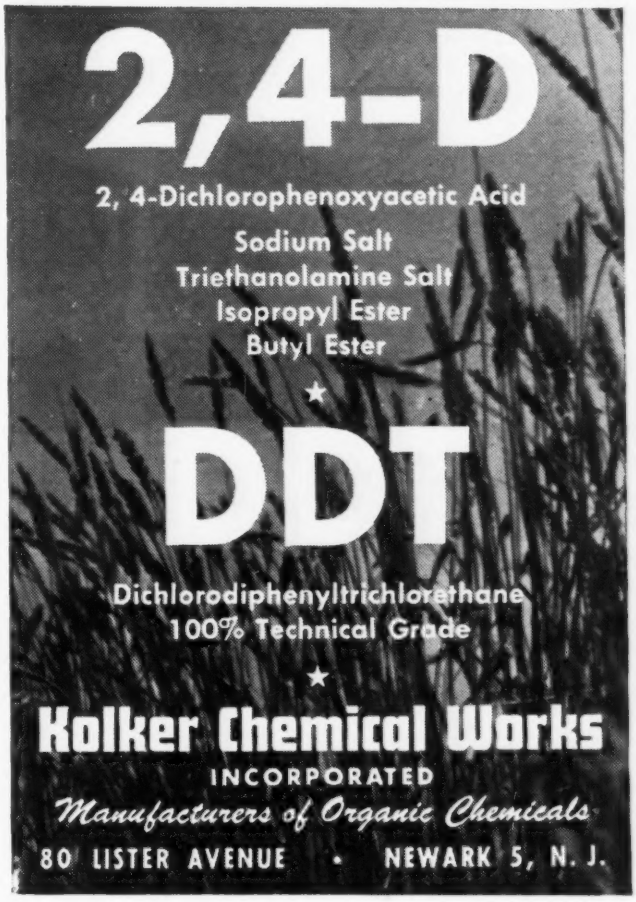
# Oils & Fats
# Shellac

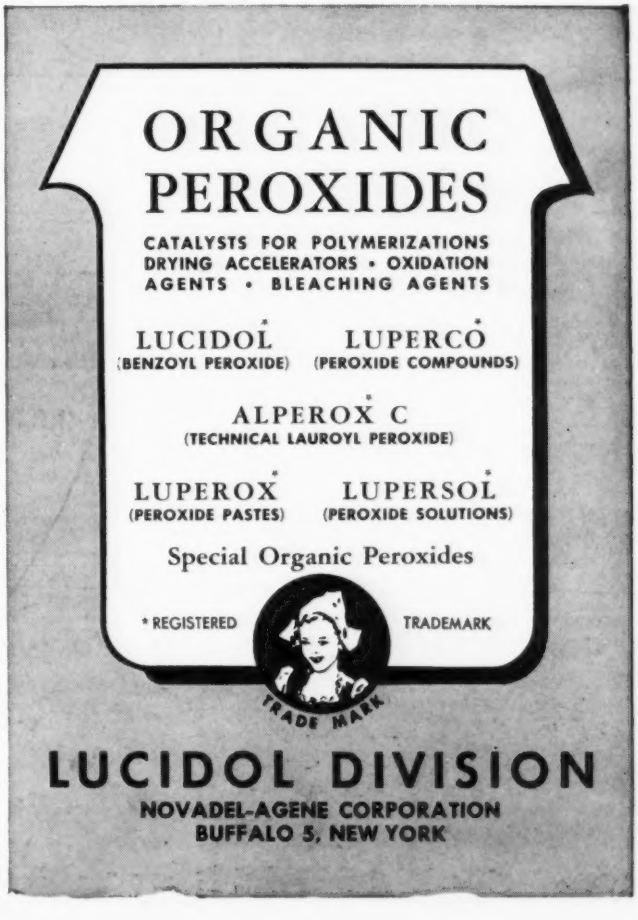
| | Current Low | Current High | 1948 Low | 1948 High | 1947 Low | 1947 High |
|---|---|---|---|---|---|---|
| Shellac, blchd. bone dry, bbls. lb. | .58½ | .63½ | .58½ | .63½ | .58½ | .74½ |
| Silver Nitrate, bots, 2,500-oz. lots oz. | .42¼ | .48 | .42¼ | .48 | .42¼ | .59 |
| Soda Ash, 58% dense, bgs, c-l, wks. 100 lbs. | .... | 1.38 | .... | 1.38 | .... | 1.38 |
| 58% light, bgs cl. 100 lbs. | .... | 1.30 | .... | 1.30 | .... | 1.30 |
| Caustic, 76% flake drs, cl. 100 lbs. | .... | 3.25 | .... | 3.25 | 2.90 | 3.25 |
| 76% solid, drs, cl. 100 lbs. | .... | 2.85 | .... | 2.85 | 2.50 | 2.85 |
| Liquid, 47-49%, sellers, tks. 100 lbs. | .... | 2.10 | .... | 2.10 | .... | 2.10 |
| Sodium Acetate, anhyd. drs. lb. | .06½ | .11 | .06½ | .11 | .06½ | .11 |
| Benzoate, USP drs. lb. | .46 | .52 | .46 | .52 | .46 | .52 |
| Bicarb, USP, gran., bgs, cl., works. 100 lbs. | .... | 2.25 | .... | 2.25 | 2.25 | 2.59 |
| Bichromate, bgs, wks l.c.l. lb. | .08¾ | .09¾ | .08¾ | .09¾ | .07⅞ | .09¾ |
| Bisulfate powd, bbls, wks. 100 lbs. | 3.00 | 3.60 | 3.00 | 3.60 | 3.00 | 3.60 |
| 35° bbls, wks. 100 lbs. | 1.40 | 1.65 | 1.40 | 1.65 | 1.40 | 1.65 |
| Chlorate, kgs, wks cl. lb. | .... | .07¼ | .... | .07¼ | .... | .06¾ |
| Cyanide, 96-98%, d.s. lb. | .14½ | .15 | .14½ | .15 | .14½ | .15 |
| Fluoride, 95%, bbls, d.s. lb. | .09¾ | .10 | .09¾ | .10 | .07¼ | .10 |
| Hyposulfite, crystl, bgs, cl, wks. 100 lbs. | .... | 2.75 | .... | 2.75 | .... | 2.75 |
| Metasilicate, granular, bbl, wks c-l. 100 lbs. | .... | 3.40 | .... | 3.40 | .... | 3.40 |
| Nitrate, imp. bgs, c.l. ton | .... | 48.00 | .... | 48.00 | .... | 42.50 |
| Nitrite, 96-98% bbl, cl. lb. | .... | .06¾ | .... | .06¾ | .... | .06¾ |
| Phosphate, dianhyd. bgs, wks. 100 lbs. | 6.25 | 7.00 | 6.25 | 7.00 | 6.00 | 7.00 |
| Tri-bgs, cryst, wks. 100 lbs. | 3.40 | 3.90 | 3.40 | 3.90 | 2.70 | 3.90 |
| Prussiate, yel. bbls, wks. lb. | .12 | .12¼ | .12 | .12¼ | .... | .12¼ |
| Silicate, 52°, drs, wks. 100 lbs. | 1.55 | 2.00 | 1.55 | 2.00 | 1.40 | 2.00 |
| 40°, drs, wks, c-l. 100 lbs. | .95 | 1.15 | .95 | 1.15 | .... | 1.15 |
| Silicofluoride, bbls, NY. lb. | .06¼ | .08½ | .06¼ | .08½ | .06¼ | .08½ |
| Sulfate tech, Anhyd, bgs. 100 lbs. | 2.10 | 2.60 | 2.10 | 2.60 | 1.70 | 2.60 |
| Sulfide, cryst c-l, bbls, wks. 100 lbs. | .... | 3.75 | .... | 3.75 | .... | 3.00 |
| Solid, bbls, wks. lb. | 3.50 | 5.50 | 3.50 | 5.50 | 3.05 | 5.50 |
| Starch, Corn, Pearl, bgs, 100 lbs. | 6.37 | 7.17 | 6.37 | 7.17 | 4.99 | 7.17 |
| Potato, bgs, cl. lb. | .0875 | .1180 | .0875 | .1180 | .0875 | .1075 |
| Rice, bgs. lb. | no stocks | | no stocks | | no stocks | |
| Sweet Potato, bgs. lb. | no stocks | | no stocks | | no stocks | |
| Sulfur, crude, mines. ton | 16.00 | 18.00 | 16.00 | 18.00 | 16.00 | 18.00 |
| Flour, USP, precp, bbls, kgs. lb. | .18 | .30 | .18 | .30 | .18 | .36 |
| Roll, bbls. 100 lbs. | 2.45 | 3.40 | 2.45 | 3.40 | 2.65 | 3.40 |
| Sulfur Dioxide, liquid, cyl. lb. | .... | .09 | .... | .09 | .07 | .095 |
| tks, wks. lb. | .04½ | .05 | .04½ | .05 | .... | .044 |
| Talc, crude, c-l, NY. ton | .... | 15.00 | .... | 15.00 | .... | 15.50 |
| Ref'd, c-l, NY. ton | 14.50 | 24.50 | 14.50 | 24.50 | 14.50 | 24.50 |
| Tin, crystals, bbls, wks. lb. | .55 | .60 | .55 | .60 | .... | .60 |
| Metal. lb. | .... | .91 | .... | .91 | .... | .80 |
| Toluol, drs, wks. gal. | .28 | .30 | .28 | .30 | .28 | .29½ |
| tks, frt all'd. gal. | .... | .23 | .... | .23 | .... | .23 |
| Tributyl Phosphates, drs, lcl, frt all'd. lb. | .68 | .72 | .68 | .72 | .... | .72 |
| Trichloroethylene, drs, wks. lb. | .09¼ | .10½ | .09¼ | .10½ | .08 | .10½ |
| Tricresyl phosphate tks. lb. | .32¼ | .36 | .32¼ | .36 | .32¼ | .33 |
| Triethylene glycol, drs. lb. | .18½ | .19½ | .18½ | .19½ | .18½ | .19½ |
| Triphenyl Phos., bbls. lb. | .26 | .29 | .26 | .29 | .26 | .32 |
| Wax, Bayberry, bgs. lb. | no stocks | | no stocks | | no stocks | |
| Bees, bleached, U.S.P. cakes. lb. | .65 | .73 | .65 | .73 | .68 | .73 |
| Candelilla, bgs, crude. lb. | .61 | .65 | .61 | .65 | .62 | .80 |
| Carnauba No. 1, yellow, bgs, ton. lb. | 1.30 | 1.55 | 1.30 | 1.55 | 1.30 | 2.00 |
| Xylol, Indus., frt all'd, tks wks. gal. | .23 | .30 | .23 | .30 | .... | .23 |
| Zinc Chloride tech, fused, wks. lb. | .0625 | .0655 | .0625 | .0655 | .05 | .0655 |
| Oxide, Amer., bgs, wks. lb. | .08½ | .10 | .08½ | .10 | .09 | .10 |
| Sulfate, crys, bgs. 100 lbs. | 4.15 | 4.90 | 4.15 | 4.90 | 3.40 | 4.90 |

OILS AND FATS

| | | | | | | |
|---|---|---|---|---|---|---|
| Babassu, tks. lb. | .14½ | .28½ | .14½ | .28½ | .14½ | .27½ |
| Castor, No. 3, drs, c.l. lb. | .27¾ | .34¼ | .27¾ | .34¼ | .27¾ | .34¾ |
| China Wood, drs, spot NY. lb. | .25¾ | .27 | .25¾ | .27 | .24 | .41 |
| Coconut, edible, drs Atlantic ports. lb. | .18 | .27 | .18 | .27 | .18 | .37 |
| Corn, crude, tks, wks. lb. | .... | .32 | .... | .32 | .... | .31 |
| Linseed, Raw, drs, c.l. lb. | .3160 | .3430 | .3160 | .3430 | .3160 | .3960 |
| Menhaden, crude tks. | .19 | .22 | .19 | .22 | .19 | .22 |
| Light, pressed, drs l.c.l. lb. | .16 | .26 | .16 | .26 | .16 | .29 |
| Palm, Niger, dms. lb. | no prices | | no prices | | no prices | |
| Peanut, crude, tks, f.o.b. wks. lb. | .17 | .30 | .17 | .30 | .20 | .37 |
| Perilla, crude, dms, NY. lb. | no stocks | | no stocks | | no stocks | |
| Rapeseed, bulks. lb. | no prices | | no prices | | no prices | |
| Red, dms. lb. | .17¾ | .33¾ | .17¾ | .33¾ | .17¾ | .33¾ |
| Soy Bean, crude, tks, wks. lb. | .15½ | .29¾ | .15½ | .29¾ | .15¼ | .33 |
| Tallow, acidless, dms. lb. | .19½ | .35 | .19½ | .35 | .19½ | .35 |

Bone dry prices at Chicago 1c higher; Boston ½c; Pacific Coast 2c; Philadelphia deliveries f.o.b. N. Y.; refined 6c higher in each case.

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$CH_2 = C(CH_3)—COOCH_3$

| | |
|---|---|
| Boiling Point | 100.5°C |
| Specific Gravity | 0.950 |
| Refractive Index | 1.417 |
| Viscosity at 25° C | 0.59 |
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- 21—Alsop NEW s.s. #347 Filters—sealed disc type—100 to 2000 GPH
- 1—Hardinge 4'x14'6" Mill—40 HP, M.D.
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- 1—250 gal. Stainless Steel Still
- 2—Dopp 150 and 500 gal. Sulphonators
- 2—NEW Monel Swenson single effect Evaporators — karbate tubes—complete
- 1—Watson Stillman 200 ton Extrusion Press
- 7—Rotex #71 and 20"x72" single and 3 deck Sifters
- 4—12x12", 18x18", 30x30" Iron Filter Presses
- 2—Bartlett & Snow Dryers, 30" x13'—direct heat—automatic controls
- 3—Porter 40 gal. Pony Mixers—X-proof, M.D.
- 1—Sperry NEW 42x42" Wood Filter Press

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**Stoneware and Porcelain For Sale**

1 Kettle, Stoneware, 37 gallon capacity.
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3 Kettles, Porcelain, 63 gallon capacity.
5 Kettle Covers, Stoneware, fit above kettles.
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2—Vac. Shelf Dryers, lab. size and 6 shelf, 40" x 43", complete.
1—Complete Stainless Steel Fatty Acid Still.
3—Ribbon Type Stainless Steel Dry Mixers, 400 to 1,500 lb.
Complete Corn Syrup Installation.
STEEL TANKS, 10,000 gal. to 50,000 gal.
1—Sweetland No. 2 Filter.
8—Evaporators, Single or Multiple Effect, in Copper.

## DRYERS

3—Triple Pass Proctor & Schwartz Soap Dryers with flaking rolls, 6' wide conveyor, 40' and 50' long, still set up in Eastern location.
1—P. & S. Stainless Conveyor Dryer, 8' x 72', complete.
12—Rotary Drum Dryers, single and double drum, all sizes.

## FILTERS and FILTER PRESSES

15—Plate and Frame Filter Presses, cast iron, aluminum, wood, etc., from 12" to 42", state requirements.
9—Rotary Vacuum Filters, Oliver, Portland, Feinc, up to 8' x 12'.

## REACTORS

4—Jacketed and Agitated 1,700 gal. Steel Reactors.
2—New Stainless Steel and Monel Jcktd., Agitated Reactors, 1,500 gal. and 2,500 gal.

## MIXERS

30—Heavy Duty Jacketed Mixers, double arm, sigma or naben blades, tilting, geared both ends.
5—Readco Double Ribbons Jacketed Mixers, 210 gal.
60—Mixing Kettles and Tanks, all metals and sizes.
40—Ribbon Type Dry Mixers up to 3,000 lbs.

## MILLS

4—Abbe Silex Lined, 3' x 3'6", 6' x 5' and 6' x 8'.
6—Hardinge Mills, 3' x 8', 4' x 8', others.
10—Roller Mills by Day, Ross, Kent, Lehman, 12" x 30" and 16" x 40".

**LARGE FILTER PRESSES**
**36" and 42" Plates**
**Cast Iron and Wood**

**ROYLE EXTRUDERS**
**for RUBBER-PLASTICS**

**HEAVY DUTY MIXERS**
**100 gallon Jacketed, double arm-geared both ends; tilting**

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**probably the largest stock in the country for all pressures and tablet sizes**

**FITZPATRICK COMMINUTORS**
**in Stainless Steel**

**New STAINLESS EQUIPMENT**
**in Kettles, Mixers, Tanks, Fillers**

## CENTRIFUGAL EXTRACTORS

8—Centrifugal Extractors, Tolhurst, American, 20" to 72", perforate and solid baskets, suspended or self-balancing, steel, copper or stainless.

## PULVERIZERS and GRINDERS

6—Mikro Pulverizers, Nos. 1, 2 and 4, some in Stainless.
10—Fitzpatrick Model D, Stainless Steel Comminuting Machines.
45 others by Raymond, Williams, Gruendler, Stedman, Schutz-O'Neill.

## TABLET PRESSES

40—Rotary and Single Punch Machines by Stokes, Colton, Kux, please state tonnage, size and depth and capacity of tablets.

•

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## COMPLETE BOILER PLANT

45,000 lbs. per hour capacity

1—Erie City Water Tube Boiler, 45,000 lbs. per hour capacity, ASME Code and National Board stamped, 180 lb. pressure, 3 drums; pulverized coal fired with type C Unitype Pulverizer; feed waterheater; steam driven boiler feed pump. Steel coal bin for 275 ton storage and Bucket Elevator 46' centers.

In addition there is an Erie City Unitype Pulverizer, size A, for use at low loads, 1250 lbs. capacity per hour, driven by 30 H.P. Westinghouse motor, 3/60/440 volts. This unit can be purchased with or without the additional Pulverizer.

EXCELLENT CONDITION - ALMOST NEW

## PUMPS

3—Gould 250 GPM 30' head, 4" suction, 4" discharge w/o motor.

2—Gould 400 GPM 280' head direct connected to 50 HP 3/60/440 volt motors.

1—Worthington monobloc size 4 DE 5, driven by 15 HP 3/60/220/440 volt motor.

6—Westco Turbine Type Pump BR 630 series E size 2½" 80 GPM 50' head, or 25 GPM 250' head, driven by 5 HP 3/60/220/440 volt motors.

1—Ingersoll-Rand 6 ALV 2000 GPM 188' head w/o motor.

1—Peerless Deep Well Turbine Pump 500 GPM 138' head driven by 25 HP 3/60/440 volt motor.

1—Morris Machine Works Boiler Feed Pump 4" four-stage 350 GPM driven by 100 HP Curtis Steam Turbine.

## BLOWERS

23—Buffalo 40" Type R with Everdur Blades w/o motors.

13—Lehigh #1 force draft blowers with 1/6 HP, 1/60/115 volt motors.

4—Lehigh #1 force draft blowers with ½ HP, 1/60/110/220 volt motors.

1—Spencer Turbo Compressors 900 CFM at ¾# pressure with 5 HP, 2/60/220 volt motor.

30—Buffalo Forge Type 5E Everdur Wheel with 5 HP 3/60/220/440 volt motor; also w/o motors.

2—Sturdevant size 2, design 3, Monogram Fan with 2 HP TEFC 3/60/220/440 volt motors.

1—Sturdevant #2 Positive Pressure Blower w/o motor.

8—American Blower 3300 CFM belt driven by ¾ HP, 3/60/220/440 volt motors.

(Other Blowers available up to 60,000 CFM)

## MILLS

1—Day 3-Roller Mill, slow speed, size 16" x 40".

1—Gruendler Laboratory Grinder, Hammermill type 8" x 6".

1—13" Jr. Disc Grinder, Robinson Mfg. Co.

## ROTARY KILN

New 1939—Used 4 months only

1—Allis Chalmers 5'-6" x 25' Rotary Kiln 9/16" plate, welded construction with 2½" Superex and 4½" Firebrick Insulation, equipped with Allis Chalmers patented gas pressure type seals. Complete.

## AUTOMATIC WEIGHING MACHINE

1—Automatic Weighing Machine, Mfg. Automatic Scale Co., cap. ¼ oz. to 3#.

## AIR COMPRESSOR

1—Ingersoll-Rand Compressor Type 40, 7" and 6¼" x 5" delivering 156 CFM at 100# with 40 HP Gen. Elec. TEFC motor 3/60/220/440 volt, 900 RPM, Receiver and Control.

## AIR RECEIVER

1—5' diam. x 14'; Vertical.

## WELDED STEEL TANKS

3—Horizontal Storage Tanks 4'-0" diam. x 18'-0" long, dished heads, 100# WP, cap. 1800 gals.

3—Horizontal Storage Tanks 5'-0" diam. x 12'-0" long, ⅜" shell, ½" dished heads, cap. 1900 gals.

3—Vertical Jacketed Process Tanks 5'-6" ID x 5'-6" high, 30# WP, cap. 1100 gals.

6—Chlorinator Drums 3' OD x 10' long 175# WP.

1—Rubber lined horizontal Welded Steel Storage Tank, 10'-6" diam. x 14'-0" long, ⅜" shell and dished heads, ¼" rubber lining.

## FILTER

Oliver Continuous Filter 4' diam. x 6' face 80 sq. ft. area with cast lead shell, lead covered, bronze head and end rims.

## STAINLESS STEEL FLANGED GATE VALVES

PIONEER—POWELL—ALLOYCO

SIZES: ¾" to 6"

## Air Conditioning Units

1—Frigidaire Compressor Model FE 102, nominal capacity 20 tons with EC-202 Evaporative Condenser, #3052-F3 and #3052-F4 Freon cooling coils. Powered by 20 HP, 3 phase, 60 cycle, 220/440 volt, 1770 RPM Motor.

1—30 ton Carrier Air Conditioning Unit consisting of two—2 cylinder Compressors and 2—15 HP Motors mounted on common base; with Kathabar Unit complete with all accessories, starters and instruments. Electrical characteristics 3-60-220-440. New 1942. Has been in use one season.

## RAYMOND MILL

1—3-roll Low Side Raymond Mill complete with Separator; Raymond #8 fan, 6'-0" diam. cyclone; interconnecting piping, loading bucket elevator and motors.

## NEW AC MOTORS

3/60/220/440 VOLTS

| Quan. | H.P. | Speed | Remarks |
|---|---|---|---|
| 3 | ½ | 1200 | 220 V.—T.E. |
| 1 | ½ | 1200 | T.E. |
| 1 | ½ | 1800 | T.E.N.V. |
| 3 | 1 | 1200 | T.E. |
| 1 | 1 | 1200 | X.P. |
| 1 | 1 | 1800 | 220 V.—X.P. |
| 2 | 1½ | 1200 | T.E. |
| 1 | 1½ | 1200 | T.E. w/Brake |
| 1 | 1½ | 1800 | T.E. |
| 1 | 1½ | 1800 | X.P. |
| 2 | 1½ | 3600 | T.E. |
| 6 | 2 | 1200 | T.E.F.C. |
| 1 | 2 | 1800 | X.P. |
| 1 | 2 | 1800 | Open |
| 1 | 2 | 3600 | T.E. |
| 2 | 2 | 3600 | T.E.F.C. |
| 1 | 3 | 1200 | X.P. |
| 1 | 3 | 1200 | 208 V.—X.P. |
| 2 | 3 | 1800 | T.E.F.C. |
| 3 | 3 | 3600 | T.E.F.C. |
| 1 | 5 | 1200 | X.P. |
| 6 | 5 | 1200 | T.E.F.C. |
| 1 | 7½ | 1200 | T.E.F.C. |
| 1 | 7½ | 1200 | X.P. |

1/60/110/220 VOLTS

| Quan. | H.P. | Speed | Remarks |
|---|---|---|---|
| 7 | 1 | 1200 | T.E. |
| 3 | 1½ | 1800 | X.P. |
| 1 | 2 | 1200 | Open |
| 1 | 3 | 1800 | Open |

## NEW GEAR MOTORS

3/60/220/440 VOLTS

| Quan. | H.P. | Output RPM | Remarks |
|---|---|---|---|
| 1 | ¼ | 96 | 440 V—Open |
| 1 | 1/3 | 72 | 440 V—Open |
| 1 | ½ | 86.2 | Open |
| 1 | ½ | 290 | Open |
| 1 | 1 | 37 | Open |
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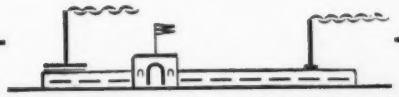

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(*Continued from page 248*)

long. A small pad welded to the end of each leg of the spider holds a bolt which is tightened against the inside wall of the tank. The distance from the open end of the center pipe and the closed concave end of the tank is one foot.

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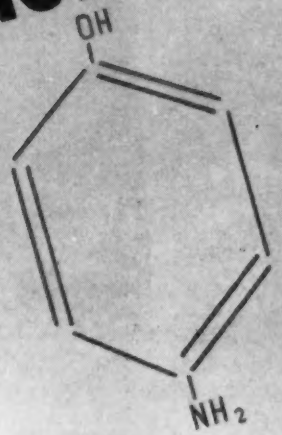


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# "WE"— EDITORIALLY SPEAKING

AFTER WE WISHED you a Happy New Year on this page last month, someone called our attention to the January 1 edition of the *New York Journal-American*. The top headline, in red as usual, said

HAPPY NEW YEAR

and this was followed by three successively smaller headlines in black saying

3 CONVICTED AS HINTZ KILLERS
POLICE LIMIT AUTO TRAFFIC
L.I. RR SERVICE HALTS AGAIN

It wasn't all that bad, of course. Back on page 7 we found an item of moderately good cheer, but we forget what it was.

"ADMINISTRATION OF ADRENALIN magnified 'nervous' behavior in neurotic sheep," says a paper on our desk at the present moment. Boy, a sheep is the last animal on earth we'd expect to be neurotic—they always look so calm and complacent. Just goes to show that you never know what worries the other fellow might have. On thinking it over, it's probably because they have to wear wool right next to the skin in warm weather.

ONE OF OUR FAVORITE speakers, Robert Hockett of the Sugar Research Foundation, was commenting recently on the difficulty of explaining scientific research to the layman. He told of an actual encounter between a scientist and a local yokel on one of the beaches in Massachussetts. The scientist was struggling up the shore towards his automobile with a large basket of wet sea weed on his back when he was accosted by this puzzled spectator.

Local: What in heck you got there, Mister?

Prof.: Why this is just a basket of seaweed that I am going to take back to my laboratory.

Local: You don't say! Is it good for something?

Prof.: Well, I am planning to get some sugar out of it.

Local: Sugar! Gee, why don't you get it at the grocery store? That would be a blame sight easier!

Prof.: Oh, this will not be ordinary sugar. It is a special and rare kind that I will get out of this weed.

Local: Does it taste better than ordinary sugar?

Prof.: As a matter of fact I do not know how it tastes. I had not even thought about its taste. I want it because it is one of the few sugars that has no primary hydroxyl group. I am curious to know whether a sugar with no primary hydroxyl group will react with triphenylchloromethane.

Local: Criminently! You must be one of them scientists! I hear they always want to know something crazy.

Prof.: It may not be so crazy. We do not consider it crazy to try out a new gun before starting on a grizzly bear hunt. When you get hold of a new weapon you want to know how it feels and how it handles. You have to learn its powers and limitations, its range, its recoil and how to adjust the sights. This triphenylchloromethane is a kind of new gun in the arsenal of the organic chemist. He wants to know just what he can do with it before some big game like a vitamin or a hormone or a new alkaloid comes along. Of course, the man who invents new weapons or fashions new tools does not often get much in the limelight. The man who happens to pull the trigger and kill the bear gets the notoriety. But the tool-makers and testers get a lot of fun just the same, and when the bear is finally shot they have a sense of participation, even though the bear-skin rug is in somebody else's parlor.

Needless to say, the citizen had wandered away long before this speech was finished, and our good scientist was alone with his seaweed.

## *FIFTEEN YEARS AGO*
(From Our Files of February, 1933)

*Chemical industry represented at hearings of Tariff Commission on "American Evaluation" and of Ways and Means Committee on "Depreciated Currency" concerned with the problem of products being imported to this country at prices so low as to seriously affect domestic manufacturers.*

*Senator Hatfield of West Virginia forecasts "dumping" of Chilean nitrate and iodine stocks in this country.*

*President-elect Roosevelt visits Muscle Shoals. It is reported that his plan contemplates operation of the plant under the Norris bill.*

*Williams H. Nichols medal of the N. Y. Section, A. C. S. for 1933 is awarded to Wilder D. Bancroft, professor of physical chemistry at Cornell for his work on the application of colloid chemistry to physiological problems, particularly insanity, in which he has advanced scientific proof that dementia and drug addiction are curable chemically.*

*F. J. King, chief engineer of Linde Air Products, is elected president of the Compressed Gas Manufacturers' Association at the annual meeting.*

*Du Pont Cellophane files suit against two companies alleging they had sold as "Cellophane" products not made by the Du Pont Company.*

## *THIRTY YEARS AGO*
(From Our Files of February, 1918)

*The Chemical Alliance, Inc. holds first Annual Convention in New York. Largest gathering of its kind ever held in U. S.*

*According to reports, Du Pont Chemical Works will be ready to make deliveries of synthetic indigo by 15th of month.*

*Atlas Powder Co. acting for Government begins construction of $6,000,000 nitrate of ammonia plant near Perryville, Md.*

*Monsanto Chemical Works, St. Louis, incorporates in Illinois with capital stock of $70,000 of which $28,000 will be devoted to manufacturing chemicals and dyestuffs at East St. Louis, Ill.*

***"How is the new process going out in the plant, Mr. Quimby?"***

THE MORNING MAIL brought a letter addressed to our "Bias Guide Department." Such a cruel word for someone trying hard to be impartial!

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| METHYL ETHYL KETONE | $CH_3$-CO-$C_2H_5$ | 72.1 | 79.6 | 34 | 28 | 71.2 | 6.71 |
| METHYL ISOBUTYL KETONE | $CH_3$-CO-$CH_2$-$CH(CH_3)_2$ | 100.2 | 115.9 | 81 | 60 | 15.2 | 6.67 |
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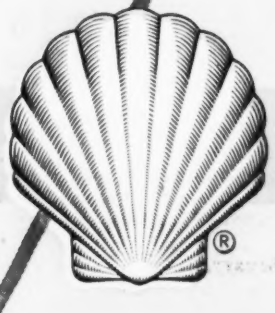

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# *Abstracts of U. S. and Foreign Patents*

## A Complete Checklist Covering Chemical Products and Processes

Printed copies of U. S. patents are available from the Patent Office at 25 cents each. Address the Commissioner of Patents, Washington, D. C., for copies and for general information concerning patents or trade-marks.

Requests for further information or photostated copies of Canadian patents should be addressed to the Commissioner of Patents and Copyrights, Department Secretary of State, Ottawa, Canada.

*U. S. Patents from Official Gazette—Vol. 603, Nos. 1, 2, 3, 4 (September 23-October 14)*
*Canadian Patents Granted and Published December 2-December 16*

### *Textiles

**Water repellent coating composition** for textiles comprising cellulose dissolved in aqueous solution of sodium zincate containing excess of sodium hydroxide and emulsified therein, as discontinuous phase, waterproofing wax water soluble emulsifying agent, water. No. 2,426,300. Sidney M. Edelstein.

**Enhancing rate of absorbency and rate of drying of cellulosic textile material** comprises treating material under steam pressure at temperature above boiling point of water in alkaline aqueous solution containing alkali metal hydroxide and amount not more than 5% of weight of cellulose of alkyl phosphate. No. 2,426,561. David M. Musser to Pacific Mills.

**Wet spinning of acrylonitrile polymer yarn** comprises extruding solution in dimethyl formamide of acrylonitrile polymer through shaped orifice into spinning bath of glycerol. No. 2,426,719. William W. Watkins to E. I. du Pont de Nemours & Company.

**Textile finishing composition** comprising aqueous solution of water-soluble methoxymethyl melamine dispersed therein aliphatic alcohol. No. 2,426,770. John Marshall Grim to American Cyanamid Company.

**Improving properties of water-insoluble artificial protein fibres.** No. 2,426,861. Giampiero Comolli to Sandoz A. G.

**Apparatus for stretching of continuous filament material.** No. 2,427,054. Thomas Jackson and Frank Brentnall Hill to Celanese Corporation of America.

**Chlorinating wool** and other keratinous textile fibers. No. 2,427,097. Jonas Kamlet and Mark Weisberg and Leo Beer.

**Production of textiles and other articles** having basis of polyvinyl compound. No. 2,427,126. Henry Dreyfus.

#### *Canadian*

**Rope of regenerated cellulose.** No. 444,781. Claude George Bonard (Donald Finlayson and Richard Gilbert Perry).

**Waterproofing organic fibrous materials** by treating with a mixture of from 45 to 55 mol per cent trimethyl silicon chloride and 55 to 45 mol per cent silicon tetrachloride. No. 444,953. Canadian General Electric Co., Ltd. (Francis J. Norton).

**Process of hardening a proteinaceous fibre.** No. 445,261. National Dairy Products Corp. (Francis Clarke Atwood).

### *Agricultural*

**Treating grass** which includes steps of extracting it with organic solvent for pigments, passing solution obtained over bone meal. No. 2,428,740. Thomas Barton Mann.

**Recovering wax** from cachaza, comprises treating cachaza having water content from 60 to 85% with water-immiscible organic solvent for wax, separating wax-laden solvent and treated cachaza. No. 2,428,813. Fred H. Rhodes and Oscar J. Swenson.

### *Biochemical*

**Extraction of selective horse bean proteins in acid media.** No. 2,427,760. Frederic A. Beique.

**Hardening protein fibre.** No. 2,428,603. Francis Clarke to National Dairy Products Corporation.

**Producing glycerine and yeast** by fermentation of carbohydrates with yeast. No. 2,428,766. Arthur L. Schade to The Overly Biochemical Research Foundation.

### *Cellulose*

**Improving manufacture of shredded alkali cellulose** from refined chemical pulp comprising incorporating cation-active sulphonium compound. No. 2,428,387. Paul Henry Schlosser and Kenneth Russell Gray to Rayonier, Inc.

**Preparing flame-resistant fibrous cellulosic material** comprising reacting anhydrous vegetable fibrous cellulosic material with hot solution of 2,4,6-trichlorophenyl isocyanate in pyridine. No. 2,428,843. Louis W. Georges and Carl Hamalainen.

**Making cellular filling for double-skin structural element** includes applying to cellulosic sheet lines of adhesive superimposing number of such sheets into stack with adhesive lines alternately staggered, cutting stack of sheets at right-angles to adhesive lines ino slices of width desired for thickness of cellular filling, opening out non-adhering walls to form lattice. No. 2,428,979. George May to Dufay-Chromex Ltd.

#### *Canadian*

**Cellulosic material** having hydrophobic properties and characterized by the presence on its surface of an absorbed coating of a complex compound of the Werner type. No. 445,457. Canadian Industries, Ltd. (Ralph Kingsley Iler).

### *Ceramics*

**Vitreous enamel opacifying material.** No. 2,427,682. Anthony J. Lubertine to Pemco Corporation.

**Cement** having retarded set, comprising hydraulic cement mixed with one of group of carboxymethylcellulose and salts of carboxymethylcellulose. No. 2,427,683. Norman C. Ludwig to Universal Atlas Cement Company.

**Polishing material** capable of forming smooth optical surface of high brilliance on glass comprises classified fraction of finely subdivided zirconium silicate. No. 2,427,799. William T. Maloney.

**Firing system for burning of refractory ware.** No. 2,428,169. Edward T. Mankin.

**Inhibiting attack and dissolution of glass and ceramic surfaces** by caustic soda solutions, comprises subjecting surfaces to contact with aqueous solution of 1 to 5% by weight of caustic soda content, incorporating therein on basis of each 96 parts by weight of NaOH, 4 parts of material selected from tannic acid, gallic acid, pyrogallic acid and naturally occurring tannins. No. 2,428,187. Walter F. Wegst and Perle N. Burkard to Wyandotte Chemicals Corporation.

**Porcelain enameling sheet** metal which is so thin that it would collapse if supported on rests during fusion of the enamel thereon. No. 2,428,307. Robert G. Calton.

**Cleaning highly polished glass surfaces** with completely saponified cellulose ester textile material. No. 2,428,443. William Whitehead to Celanese Corporation of America.

**Apparatus for continuously forming and curing magnesia insulation blocks** comprising, extruder heating jacket, means for circulating heating fluid, etc. No. 2,428,555. Arthur B. Cummins and August M. Dinkfeld to Johns-Manville Corporation.

**Stainless and treating glass** with copper, comprises subjecting hot, alkali-containing glass surface to action of vapors of volatile copper halide. No. 2,428,600. Helen S. Williams to Glass Science, Inc.

**Mineral wool apparatus** including means for discharging molten material stream many times larger than fibers to be formed therefrom. No. 2,428,810. Edward R. Powell to Johns-Manville Corporation.

**Glass tempering medium** comprising molten bath containing salt selected from alkali nitrates and nitrites and from 5% to 10% of low meting point alloy and comprises zinc 93%, aluminum 4%, copper 3%. No. 2,429,129. George Heppell and Walter Francoeur.

### *Coatings

**Coating composition for welding electrodes** comprising ligno-cellulosic material. No. 2,427,966. Carl Jonathan Hirschler and William George Campbell.

**Applying reflection reducing coating** to transparent glass, step of applying alkali metal silicate to surface, etc. No. 2,428,357. Morris U. Cohen and Joseph Steigman.

**Apparatus for coating electrolytically** continuous length strip material, means for melting coating thereon to obtain smooth, high-luster finish, etc. No. 2,428,362. Klaus Egge to Carnegie-Illinois Steel Corporation.

**Liquid coating composition** for determining strain concentration in rigid article and drying by evaporation to form uniformly brittle film responsive to strains by cracking. No. 2,428,559. Greer Ellis to Magnaflux Corporation.

**Providing protective coating** on surface of articles formed of magnesium-base alloys. No. 2,428,749. Herbert K. DeLong to The Dow Chemical Company.

**Measuring thickness of coating** on crystalline material comprising directing beam of X-rays onto coated material, intercepting rays comprising lines of diffraction pattern of crystalline material, determining intensity as compared with intensity of similar lines from uncoated crystalline material. No. 2,428,796. Herbert Friedman.

**Treating soya bean oil** to increase its drying rate and transform it into wrinkling oil comprises heating 100 parts of oil with 0.05 part of sodium at 120°C. No. 2,428,901. Gordon M. Williams to New Wrinkle, Inc.

**Apparatus for coating article having contoured surface.** No. 2,428,991. Harold P. Ransburg to Harper J. Ransburg Company.

**Coating composition** comprising 10 to 70% paraffin wax, 20 to 80% pertrolatum, from 1% to 8% of lead soap of saturated fatty acids of 12-24 carbon atoms. No. 2,429,150. John C. Zimmer and Ejnar W. Carlson to Standard Oil Development Company.

#### *Canadian*

**Of protecting and preventing retraction** in a polarizing element by treating the polarizing element with a silica compound. No. 445,396. Alvin Marks (Gerhart Weiss).

### *Dyes, Pigments*

**Acetoacet-methine color formers.** No. 2,427,910. John David Kendall and Douglas James Fry to Ilford Limited.

---

* *U. S. Patent from Vol. 602, Nos. 1, 2, 3, 4.*
*Canadian from October 28 - November 25.*

**3,5-Diketo pyraxolidine color formers.** No. 2,427,911. John David Kendall and Douglas James Fry to Ilford Limited.

**Sulfofluorides of azoic dyestuffs.** No. 2,427,995. Robert Prescott Parker and Corris Mabelle Hofmann to American Cyanamid Company.

**Hydrophilic synthetic linear polyamide color former** containing plurality of color former units of structure described in patent. No. 2,428,108. David Malcolm McQueen to E. I. du Pont de Nemours & Company.

**Tris and polyazo dyes from tetrazotized 0:0' dihydroxybenzidine.** No. 2,428,130. Fritz Straub, Jakob Brassel and Peter Pieth to Swiss firm of Society of Chemical Industry.

**Coloration of textile material** containing organic derivative of cellulose with leuco sulfuric esters of vat dyestuffs. No. 2,428,833. Cyril M. Croft and Walter H. Hindle to Celanese Corporation of America.

**Dyeing of cellulose acetate fabrics** with direct dyeing dyestuffs, lower aliphatic alcohols and lower aliphatic acids. No. 2,428,834. Cyril M. Croft and Walter H. Hindle to Celanese Corporation of America.

**Dyeing of fabrics** comprising cellulose acetate with alcohol-thiocyanate swelling mixture. No. 2,428,835. Cyril M. Croft and Walter H. Hindle to Celanese Corporation of America.

**Printing of cellulose acetate fabrics with acid dyes.** No. 2,428,836. Cyril M. Croft and Walter H. Hindle to Celanese Corporation of America.

**Chroming chromable monoazo dyestuff** containing one sulfonic acid group and two aromatic nuclei selected from nuclei of benzene and naphthalene series. No. 2,428,866. Achille Conzetti and Guido Schetty and Otto Schmid to J. R. Geigy.

**Converting polyphenylated rosaniline spirit blue to lower degree of phenylation** and improved shade. No. 2,429,081. Henry N. Steuber to American Dyewood Company.

### *Canadian*

**As a new product,** free-flowing diazodinitrophenol in the form of tabular crystals containing an absorbed triphenyl-methane dye. No. 445,496. Olin Industries, Inc. (Frederick M. Garfield and Herman W. Dreher).

## *Equipment*

**Extracting device** for separating fluids from high consistency fluid-solid mixtures. No. 2,427,662. Joaquin J. de La Roza, Sr.

**Liquid level measuring system** comprising U-tube, control housing, conduit means. No. 2,427,690. Carl W. Peterson.

**Pump and gas lift.** No. 2,427,703. Hugh S. Berkey.

**Mercury vapor tube.** No. 2,427,732. Ruric C. Mason to Westinghouse Electric Corporation.

**Electrical dust precipitator.** No. 2,427,740. Edward H. R. Pegg to Westinghouse Electric Corporation.

**In control system for electrolytic process,** generator means for supplying current to electrolytic process, exciter for generator means, means for varying excitation of generator means in accordance with speed of travel of length of material through electrolytic process, etc. No. 2,427,771. John R. Erbe to Westinghouse Electric Corporation.

**Apparatus for treating fluent materials** of type which effervesce when subjected to vacuum. No. 2,427,786. Cyril N. Hoyler to Radio Corporation of America.

**Fluid filtering unit.** No. 2,427,862. George H. Judkins to International Harvester Company.

**Machine for extrusion of material in plastic state.** No. 2,427,960. Francis Tadman Griffiths to W. T. Henley's Telegraph Works Company, Ltd.

**Rotatable means for decanting liquids from solids.** No. 2,427,967. Manfred T. Hoster.

**Hydroxylating pot type hydrocarbon burner.** No. 2,428,009. James L. Breese to Breese Burners, Inc.

**Apparatus for removing gaseous or readily vaporizable materials from liquid.** No. 2,428,045. Paul F. Sharp, David B. Hand and Edward S. Guthrie to Cornell Research Foundation, Inc.

**Composite selenium electrode.** No. 2,428,055. Arthur von Hippel and James H. Schulman to Federal Telephone and Radio Corporation.

**Apparatus for puffing slag.** No. 2,428,249. John C. K. Stuart and Albert H. Vanderburgh to Insulation Products, Ltd.

**Apparatus to pump from body of liquid to point appreciable distance above body.** No. 2,428,256. De Witt E. Yates to W. S. Darley & Company.

**Apparatus for supplying water vapor to oxygen gas delivered to nasal catherer.** No. 2,428,277. Jay A. Heidbrink to Air Reduction Company, Inc.

**Go-devil device for locating obstructions in pipe lines.** No. 2,428,326. Charles H. Fay to Shell Development Company.

**Adjustable colloid mill.** No. 2,428,415. Edwin G. Eppenbach and Henry Imshaug.

**With closure** for opening of tank for liquid, container for dehydrating material mounted on closure. No. 2,428,426. Lynn G. Lindsay.

**In iron hot water tank** having glass lining on inner surface means for preventing dissociation of iron in cracking of glass lining. No. 2,428,526. Clark M. Osterheld to McGraw Electric Company.

**Smoke-generating apparatus** comprising heater chamber having discharge opening adapted to contain liquid fuel, control device to maintain liquid fuel in heater, electric immersion heater, etc. No. 2,428,580. Willis A. Pennow to Westinghouse Electric Corporation.

**Prevacuumizing filling machine.** No. 2,428,598. Jesse E. Weaver to Horix Manufacturing Company.

**Metal insert for molded plastic objects.** No. 2,428,676. George A. Moore, George A. Moore, Jr., Harrington Moore and Lawrence Moore.

**Sedimentation chamber** for separating solids from liquids having flow distributing means. No. 2,428,756. Arthur C. Lind to Chain Belt Company.

**Thermostatic circuit controlling device.** No. 2,428,838. John H. Derby.

**Method, apparatus for producing capsules.** No. 2,428,911. Robert W. Gunnell to Industrial Sound Systems, Inc.

**Liquid vaporizing unit** to produce small bubbles of vapor from liquid upon heating in liquid whereby bumping during boiling is eliminated. No. 2,428,916. Maryan P. Matuszak to Phillips Petroleum Company.

**Liquid distributing apparatus.** No. 2,428,922. Allen M. Shoresman to Universal Oil Products Company.

**Oil and water separator having vertically spaced oil and water outlets.** No. 2,428,927. Carl R. Briggs one-half to John Cunningham.

**Rotary drum stratifier** as separator for minerals differing in specific gravities. No. 2,428,974. Ernest Kreher.

### *Canadian*

**Vapour separating pump and impeller.** No. 445,312. (Miles Lowell Edwards).

**Apparatus for conducting reaction** in liquid phase under pressure. No. 445,333. American Cyanamid Company. (William F. Caldwell, Robert C. Swain and Joseph H. Paden).

## *Explosives*

**Blasting cap of fuse type.** No. 2,427,899. Lawton A. Burrows to E. I. du Pont de Nemours & Company.

**Hydrophobic single base smokeless powder** produced from stable cellulose nitrate with nitrogen contents from 13.8 to 14.0%. No. 2,428,829. Ernst Berl and Walter George Berl.

**Explosive device for attachment to similar explosive device.** No. 2,429,079. William F. Smith to Hercules Powder Company.

## *Food*

**Preparing dried egg products** comprising inoculating yolks and whites with organisms which feed upon reducing sugars, fermenting, and drying. No. 2,427,726. Ervin W. Hopkins, George Josh and Louis A. Harriman to Armour and Company.

**Coating mixture** for preserving foods, comprising water solution of ethylene glycol, powdered gelatin, orthodichlorobenzene, and ethyl acetate. No. 2,427,857. John Hamill.

**Once-through process for treating milk** to preserve its vitamin C content, to remove dissolved oxygen, and to retard development of off-flavor therein. No. 2,428,044. Paul F. Sharp, David B. Hand and Edward S. Guthrie to Cornell Research Foundation, Inc.

**Culture of pineapple plants** comprises applying to plants, plant hormone to cause delay of fruit and increase in size. No. 2,428,335. Ferdinand P. Mehrlich to Hawaiian Pineapple Company, Ltd.

**Improving oleaginous glyceride oil and fat stock,** comprises adding formaldehyde and mineral acid catalyst. No. 2,428,367. Lloyd F. Henderson and Louis H. Libby to Lever Brothers Company.

**Fruit concentrate** containing water soluble salt of amylopectin glycolate. No. 2,428,636. Ramon Perech.

**Imparting colors to cereal particles** consists in mixing dry cereal particles with finely ground edible pigments and subjecting to steam pressure for increasing absorption. No. 2,428,665. Chastain G. Harrel and Robert O. Brown to Pillsbury Mills, Inc.

## *Inorganic*

**Extracting oxygen** from mixture of oxygen with inert gas comprising passing streams of mixture and steam over manganate type contact mass. No. 2,427,706. Eugene O. Brimm to The Linde Air Products Company.

**Extracting oxygen** from mixture of oxygen with inert gas comprising passing streams of mixture and steam over manganate type contact mass. No. 2,427,707. Eugene O. Brimm to The Linde Air Products Company.

**Extracting oxygen** from mixture of oxygen with inert gas comprising passing streams of mixture and steam manganate type contact mass. No. 2,427,708. Eugene O. Brimm to The Linde Air Products Company.

**Extracting oxygen** from mixture of oxygen with inert gas comprising passing streams of mixture and steam over manganate type contact mass. No. 2,427,709. Eugene O. Brimm to The Linde Air Products Company.

**Phosphor** of matrix of alkaline earth metal phosphate of pyrophosphate activated with dysprosium. No. 2,427,728. Henry G. Jenkins, Alfred H. McKeag and Peter W. Ranby to General Electric Company.

**Extracting oxygen** from mixture of oxygen with inert gas comprising passing mixture and steam over manganate type contact mass. No. 2,427,757. Fred R. Whaley and Eugene Oskar Brimm to The Linde Air Products Company.

**Production of finely divided amorphous silica** by subjecting siliceous material in reducing zone to action of carbonaceous reducing agent at temperature to cause reduction of siliceous material to silicon monoxide and to produce mixture of gaseous silicon monoxide and carbon monoxide, improvement comprises continuously withdrawing gas mixture from reduction zone. No. 2,428,178. Richard Reik and Alva C. Byrns to The Permanente Metals Corporation.

**Producing nitrogen trichloride** comprises contacting solid ammonium salt with gaseous chlorine in presence of deliquescent carrier material. No. 2,428,331. Willis S. Hutchinson to General Mills, Inc.

**Acid etching composition** comprising nitric acid, water and phosphoric acid. No. 2,428,464. John C. Lum and George W. Jernstedt to Westinghouse Electric Corporation.

**Resolution of aqueous hydrofluoric acid,** comprises vaporizing and withdrawing water from mixture of aqueous hydrofluoric acid and alkali metal fluoride. No. 2,428,524. Maryan P. Matuszak to Phillips Petroleum Company.

**Cell for electrolysis of salt solutions.** No. 2,428,584. Chester N. Richardson to The Mathieson Alkali Works, Inc.

**Regenerating spent caustic alkali solution** to remove mercaptides resulting from caustic alkali treatment of naphtha. No. 2,428,623. Amiot P. Hewlett and Henry C. Paulsen to Standard Oil Development Company.

**Composition of matter** comprising residue of mixture of chromic acid and pumicite having characteristics of that originating near Meade, Kansas. No. 2,428,785. Lewis H. Colvin to Wayne B. Colvin and Cleon Colvin.

**Deferred action dry cell with magnesium electrode.** No. 2,428,850. Herbert E. Lawson to Burgess Battery Company.

**Making alumina silica gel** comprising playing separate streams of alkali metal silicate and aluminum sulphate onto same spot on horizontal surface rotating about vertical axis, collecting reaction product discharged from rotating surface by centrifugal force. No. 2,428,895. Mark Shoeld to The Davison Chemical Corporation.

**Production of porous aluminum chloride catalyst.** No. 2,428,910. Arch L. Foster to Phillips Petroleum Company.

### *Canadian*

**Dry cell of the Leclanche type** containing zinc oxide and a compound from the group consisting of chromic acid, dichromic acid and the water soluble salts of chromic acid and dichromic acid. No. 445,342. Burgess Battery Company (Vincent Lipson).

**An aqueous dry cell electrolyte containing lithium chloride.** No. 445,343. Burgess Battery Company (Milton Edward Wilke).

**Process of obtaining a black granular iron hydrate** and an ammonium salt substantially free from iron, directly from ammonia and an iron salt. No. 445,345. Canadian National Carbon Company, Ltd. (Howard R. Wilson).

**Method for burning-vapourizing sulphur.** No. 445,357. General Chemical Company (Julius Worth Neelley).

**Method of decomposing calcium sulphate** substantially free of sulphide to produce a solid residue free from sulphur. No. 445,384. F. L. Smidth & Co. (Knud Horn).

**Process for the manufacture of calcium carbonate of a high degree of** purity and fine particle size. No. 445,480. Imperial Chemical Industries, Ltd. (Frederick Leslie Clark and William Percy Foster).

**Process for the manufacture of a metallic product rich in calcium.** No. 445,481. Imperial Chemical Industries, Ltd. (John Wilfred Britton).
**Process of preparing potassium stannate.** No. 445,493. Metal & Thermit Corporation (Hartmut W. Richter).
**Process for the preparation of neutral calcium hypochlorite.** No. 445,620. The Mathieson Alkali Works (Edward C. Soule and Homer L. Robson).

## *Medicinal*

**Treatment of anemia** comprising mixture of iron, copper and cobalt compounds. No. 2,427,692. Simon L. Ruskin to Frances R. Ruskin.
**Dialkylaminopropyl ethers of benzhydrol.** No. 2,427,878. George Rieveschl, Jr., to Parke, Davis & Company.
**Analgesic composition** comprising in admixture analgesic of antipyretic type having no narcotic effect and component to increase effectiveness of analgesic comprising non-toxic salt of sympathomimetic amine having formula described in patent. No. 2,427,887. Theodore B. Wallace to Smith, Kline & French Laboratories.
**Anthelmintic composition** comprising nicotine substance, betonite and phenothiazine. No. 2,428,444. John A. Whiting to Armour & Company.
**Ethyl ester of acetyl mandelyl-beta-alanide.** No. 2,428,535. Harold Urist and Gustav J. Martin to The National Drug Company.
**Manufacture of betaine derivatives,** comprising treating members selected from cardiac glysocides and their aglycones with member of group of acid halides and anhydrides of betaine salts. No. 2,429,171. Leopold Ruzicka and Placidus Plattner to Ciba Pharmaceutical Products, Inc.
**Manufacture of para-aminobenzenesulphonamido-pyrimidine.** No. 2,429,184. Max Hartmann, Harold von Meyenburg and Jean Druey to Ciba Pharmaceutical Products, Inc.

## *Metals, Ores*

**Brazing fillets.** No. 2,427,747. Stanley S. Schneider and Warren D. Kinsman to Westinghouse Electric Corporation.
**Making steel strip** suitable for deep-drawing, stamping and forming, comprising electroplating on cold-rolled hard un-annealed steel strip base stock at least three layers of two metals selected from tin, lead, zinc, iron, nickel, chromium, copper, bismuth, antimony, cadmium and silver, etc. No. 2,428,033. John S. Nachtman.
**Electrolytically cleaning,** stripping copper from and polishing surfaces of ferrous articles. No. 2,428,141. Thomas E. Burkhardt to General Motors Corporation.
**Apparatus for separating fine gold by screening and aqueous suspension.** No. 2,428,146. Maurice Constant.
**Permanent magnet alloy** consisting of silver content exceeding 5% and ranging up to 10%, copper content of at least 55% remainder of ferromagnetic metals. No. 2,428,205. Walter Dannohl and Hans Neumann.
**Reclaiming valuables from metal grinding dusts** and sludges comprises forming aqueous pulp of material magnetically separating magnetic and non-magnetic ingredients of pulp, etc. No. 2,428,228. Walter E. Keck to Metals Recovery Company.
**Making steel strip** comprising electroplating on steel strip base stock at least three layers of two metals selected from chromium, copper, bismuth, antimony, camdium, silver and alloys thereof, etc. No. 2,428,318. John S. Nachtman.
**Rust free surfaces on ferrous metal,** comprises subjecting to ammonium citrate, washing submerging in sodium nitrite, transferring to oil emulsion. No. 2,428,364. Max Frager.
**Electrodepositing molybdenum, and cobalt and iron** consists in passing current between anode and work as cathode in aqueous electrolyte of hexavalent molybdate compound, cobalt and iron, free alkali metal hydroxide and organic compound. No. 2,428,404. Leonard F. Yntema to President & Board of Trustees of St. Louis University.
**Beneficiation of garnet ores** by froth flotation with water-dispersible petroleum sulfonates. No. 2,428,763. Robert B. Booth and Roy A. Pickens to American Cyanamid Co.
**Copper cleaning composition** comprising 5 parts by weight sulphuric acid, 4½ parts 30% hydrogen peroxide, 3 parts acetic acid, 87½ parts water. No. 2,428,804. Esther M. Terry and Morris Kaplan.
**Zinc base alloy** containing at least 97% zinc and characterized by high creep resistance containing from 0.01 to 1.6% titanium and from 0.05 to 1.5% manganese and balance zinc. No. 2,428,959. Edward J. Boyle and Edmund A. Anderson to The New Jersey Zinc Company.
**Producing stainless steel lithographic plate** with copper image thereon. No. 2,429,107. Torsten Seved Alexander Petren and Erick Karl Willi Sternberg to Ahlen & Akerlunds Forlag.

## *Canadian*

**Methods of reducing iron ores** containing nickel oxide and chromium oxide. No. 445,405. Taddeus F. Baily.
**Method of beneficiating low grade bauxite ore** to produce a high grade bauxite suitable for use in the production of aluminum. No. 445,438. American Cyanamid Company (Roy Alderson Pickens).
**Electrodeposition of lead,** from an acidic, aqueous solution in the presence of about from .05 to 5.0 grams per litre of an anthraquinone sulphonate and 1.0 to 5.0 grams per litre of sulphite cellulose waste. No. 445,461. Canadian Industries, Ltd. (Allen Gibbs Gray).

## *Organic*

**Amine salts of trichloro-2-hydroxydiphenyl.** No. 2,427,658. Gerald H. Coleman and Wesley D. Schroeder to The Dow Chemical Company.
**Production of butadiene** comprising forming mixture of tetramethylene oxide and water, preheating, subjecting vapors to dehydrating catalyst. No. 2,427,704. Joseph E. Bludworth and Max O. Robeson to Celanese Corporation of America.
**Dehalogenating halogenated saturated hydrocarbon** wherein halogenated hydrocarbon is reacted with hydrogen in presence of hydrogenating catalyst and hydrogen halide is liberated which poisons the catalyst, improved method comprises reacting halogenated saturated hydrocarbon with hydrogen in presence of alcohol, etc. No. 2,427,791. Vladimir N. Ipatieff and Louis Schmerling to Universal Oil Products Company.

*Additional patents from the above volumes will be given next month.*


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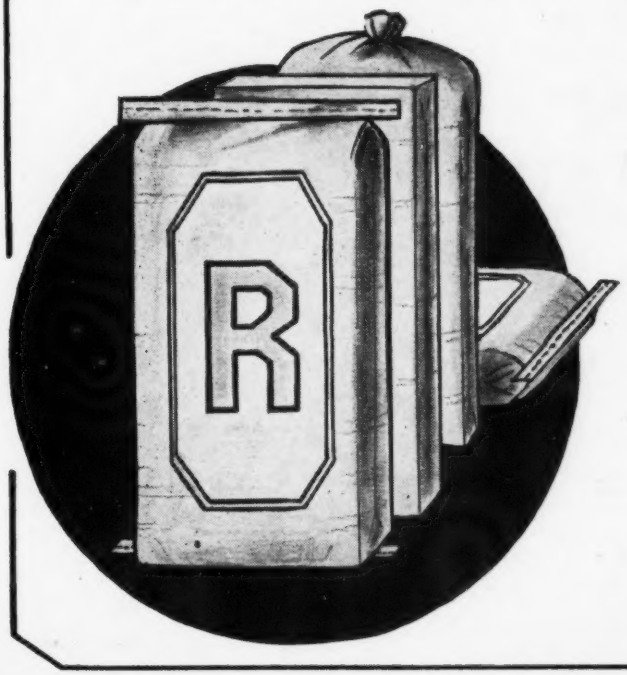

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# *Trademark of the Month*

## A Checklist of Chemical and Chemical Specialties Trademarks

**433,139.** The Brooks Oil Co., Cleveland, Ohio, filed Jan. 4, 1946; Serial No. 494,257; for lubricating oils and greases; since Dec. 27, 1945.

**433,532.** Virginia Smelting Co., West Norfolk, Va., filed Feb. 6, 1946; Serial No. 496,115; for aerosol insecticide; since Jan. 19, 1946.

**482,610.** Century Lab., Inc., Brooklyn, N. Y., filed Apr. 26, 1945; for floor cleaning and absorbing compound; since Mar. 5, 1945.

**484,847.** The Linde Air Products Co., N. Y., filed June 21, 1945; for synthetic corundum, and synthetic spinel; since May 1942.

**488,336.** Maas & Waldstein Company, Newark, N. J., filed Sept. 12, 1945; for baking primer composition for coating metal articles having chromium surfaces; since Jan. 22, 1937.

**490,046.** Leslie C. Wilson, as Duorite Plastic Industries, Culver City, Calif., assignor to Calresin Corp., Culver City, Calif.; filed Oct. 16, 1945; for sulfur containing thermoplastics in lump or rock-like form; since Aug. 31, 1944.

**496,185.** Warwick Wax Co., Inc., New York, N. Y., filed Feb. 7, 1946; for crude waxes derived from mineral sources; since about Jan. 17, 1946.

**498,357.** Osmose Wood Preserving Company of America, Inc., Buffalo, N. Y., filed Mar. 16, 1946; for non-aqueous liquid compositions containing chlorophenol and organic solvent; since Aug. 16, 1944.

**499,735.** The Special Chemicals Co., Cleveland, Ohio; filed Apr. 5, 1946; for liquid phenol formaldehyde resin; since Jan. 1, 1943.

**504,475.** Theodore J. Carski as Baltimore Biological Laboratory, Baltimore, Md., filed June 24, 1946; for powders for promoting growth of bacteria and micro-organisms; since Feb. 1, 1943.

**504,776.** The Mathieson Alkali Works, New York, N. Y., filed June 28, 1946; for monomeric dichlorstyrene, its polymers and copolymers; since June 28, 1945.

**505,554.** Boyle-Midway, Inc., Jersey City, N. J., filed July 13, 1946; for insecticides; since Mar. 27, 1926.

**505,710.** N. V. Algemeene Norit Maatschapplj, as General Norit Company, Limited, Amsterdam, Netherlands, and Jacksonville, Fla., filed July 16, 1946; for active carbon; since Jan. 5, 1914.

**506,929.** James Howard Heal, as Evaporator Service and Supply Company, San Francisco, Calif.; filed Aug. 6, 1946; for feed water and brine treatment chemicals for making fresh water out of salt water; since July 8, 1946.

**506,939.** International Explosives Corporation, Reno, Nev., filed Aug. 6, 1946; for explosives; since July 27, 1946.

**506,940.** International Explosives Corporation, Reno, Nev., filed Aug. 6, 1946; for explosives used in blasting, mining, military operations; since July 27, 1946.

**507,852.** The Resinous Products & Chemical Co., Philadelphia, Pa., filed Aug. 22, 1946; for synthetic resinous materials; since Feb. 24, 1936.

**510,225.** All-State Welding Co., Inc., White Plains, N. Y., filed Oct. 4, 1946; for welding alloys; since January 1946.

**512,191.** Monsanto Chemical Company, St. Louis, Mo., filed Nov. 7, 1946; for use in combating insects and fungi; since Oct. 2, 1946.

**512,192.** Monsanto Chemical Company, St. Louis, Mo., filed Nov. 7, 1946; for use in combating insects and fungi; since Oct. 2, 1946.

**512,574.** Celluplastic Corporation, Newark, N. J., filed Nov. 14, 1946; for plastic material; since Sept. 25, 1946.

**514,506.** Sun Oil Co., Phila., Pa., filed Dec. 18, 1946; for lubricating oil; since May 1916.

**514,509.** Sun Oil Company, Philadelphia, Pa., filed Dec. 18, 1946; for lubricating oil; since March 1921.

**514,831.** Master Bronze Powder Co., Hammond, Ind., filed Dec. 26, 1946; for aluminum paints, paste, powder, bronze powders; since June 21, 1946.

**515,447.** Ysak Pessell as Centrifugal Casting Co., N. Y., N. Y., filed Jan. 8, 1947; for resinous thermo-plastic materials; since Dec. 3, 1946.

**515,962.** Oronite Chemical Company, Wilmington, Del., and San Francisco, Calif., filed Jan. 18, 1947; for cleaning, washing and polishing compounds; since Jan. 5, 1945.

**516,812.** California Spray-Chemical Corp., Wilmington, Del., and Richmond, Calif., filed Feb. 3, 1947; for insecticides, fungicides, disinfectants and soil fumigants; since Jan. 15, 1947.

**516,902.** Interchemical Corp., N. Y., N. Y.; filed Feb. 4, 1947; for resin suitable for incorporating in paints and lacquers; since Aug. 3, 1945.

**516,903.** Interchemical Corp., N. Y., N. Y.; filed Feb. 4, 1947; for resin; since June 14, 1946.

**516,985.** Herron Bros. & Meyer, New York, N. Y., filed Feb. 5, 1947; for wax for use in rubber; since June 1944.

**517,269.** Standard Oil Company of California, Wilmington, Del., filed Feb. 10, 1947; for lubricating oils and greases; since June 12, 1945.

**517,381.** Rit Prods. Corp., Chicago, Ill., filed Feb. 12, 1947; for compound having anti-sparking, spot-removing, & dry cleaning properties; since 1935.

**517,718.** Geigy Co., Inc., N. Y., filed Feb. 18, 1947; for insecticides; since Jan. 17, 1947.

**519,465.** The Cornelius Company, Minneapolis, Minn., filed Mar. 24, 1947; for insecticides; since Jan. 1, 1947.

**519,484.** Monsanto Chemical Company, St. Louis, Mo., filed Mar. 24, 1947; for chemical toxicants for use as agricultural insecticides, fungicides and herbicides; since Feb. 7, 1947.

**519,814.** Julius Goldner as Warwick Lab. Co., Brooklyn, N. Y., filed Mar. 29, 1947, for hydraulic brake fluid, etc.; since May 1935.

**520,959.** Meb Products, Inc., Los Angeles, Calif., filed Apr. 18, 1947; for household insecticide; since Apr. 4, 1947.

**521,011.** Hardesty Chem. Co., N. Y., filed Apr. 19, 1947; for synthetic detergent in liquid, paste, or powder form; since Mar. 19, 1947.

**521,487.** The Trimit Company, Baton Rouge, La., filed Apr. 28, 1947; for weed killing sprayable liquids; since Mar. 1, 1947.

**522,403.** Refined Products Corporation, Lyndhurst, N. J., filed Fay 15, 1947; for soap substitute applied to textiles and leather as finishing agent and detergent; since April 1941.

**522,851.** Food Machinery Corporation, San Jose, Calif., and Middleport, N. Y., filed May 22, 1947; for insecticidal composition for use on plants; since Mar. 7, 1947.

**523,279.** Rohm & Haas Co., Phila., Pa., filed May 29, 1947; for resin suspensions; since Apr. 11, 1935.

**523,894.** Geigy Company, Inc., New York, N. Y., filed June 10, 1947; for mothproofing of fibers, fabrics; since Mar. 18, 1947.

**525,103.** The Permutit Company, New York, N. Y., filed June 28, 1947; for ion exchange materials for purifying and treating aqueous solutions; since June 20, 1947.

**525,538.** Carbide and Carbon Chem. Co., N. Y., N. Y., filed July 2, 1947; for chemicals for industrial and other uses; since Feb. 1, 1945.

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Name _____

Position _____

Company _____

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CHEMICAL INDUSTRIES: Feb. 1949

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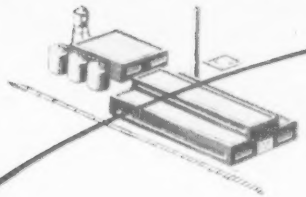

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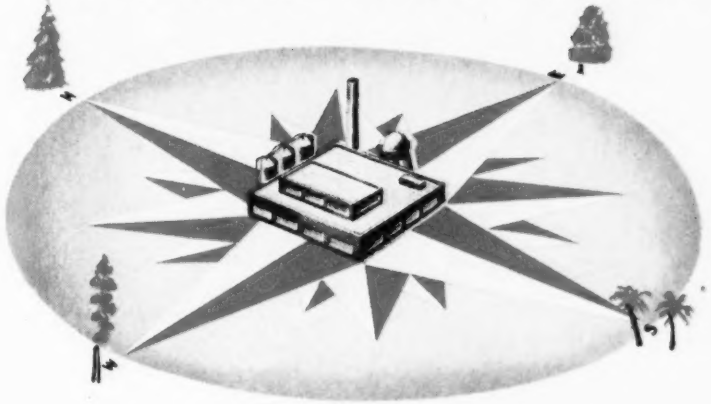

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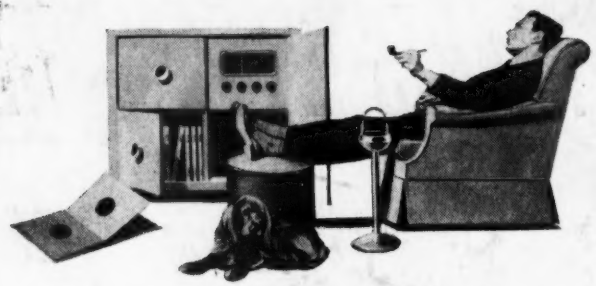

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